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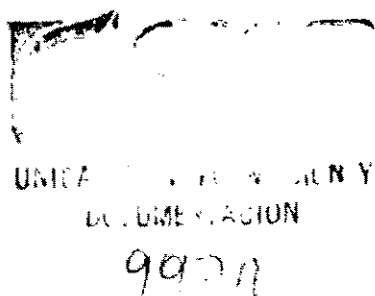
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SEED UNIT STUDY REPORT

DRAFT FOR DISCUSSION
AT WORKSHOP ON STRATEGIES FOR THE FUTURE
DEVELOPMENT OF THE SEED UNIT AT CIAT

February 16 and 17, 1987



CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL (CIAT)
CALI, COLOMBIA

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CHAPTER I. ORIGIN OF THE STUDY

The 1984 External Management Review

Since its initiation, the Seed Unit has functioned as a Special Project within the overall structure of CIAT. As noted in the Report of the External Management Review (EMR) of 1984, "There do not appear to be managerial or administrative problems, other than of a routine nature, and the Unit functions smoothly." The EMR went on to say that the Unit, "represents an imaginative and successful attempt to both service CIAT's own needs and assist National Programs." Recognizing that seed industries are essential for development, the EMR went on to say that "It is a critical issue facing most of the commodity centers in the CGIAR system and one of keen interest to developing countries."

The 1984 External Program Review

The 1984 External Program Review Report states that "The Seed Unit has made a very significant impact on the seed industry of Latin America in a period of only five years. It has responded to a major need of the region by developing an excellent training program, improving seed technology, providing basic seed and increasing communication among seed professionals." In general, the EPR commended highly the efforts of the Seed Unit and made several key recommendations for strengthening its program.

One might ask then in the light of the very positive reports of the EMR and EPR, why there is a need for study of the Seed Unit. In part the answer is found in the review reports and in part in other documents emanating both within and outside of the Consultative Group for International Agricultural Research (CGIAR) system. For example going back to the Technical Advisory Committee (TAC) Quinquennial Review of CIAT (1977)*, the following statement appears, "A major direct effect on

* CGIAR-TAC Report of the TAC Quinquennial Review Mission to the International Center of Tropical Agriculture.

crop production is known to be achieved by clean seed, but national arrangements for the multiplication and distribution of clean seed of improved varieties is sadly deficient throughout the region. Training in this technology should therefore have a high priority in CIAT programs and should be available to suitably qualified personnel of commercial seed producing enterprises." The EPR report of 1984 states that, "It is clear that a need will exist after 1986 [when the restricted core funding was due to terminate] for the activities performed by the Seed Unit. In fact, these activities will probably increase and be necessary on a global basis, especially in the area of international development activities. Therefore, a mechanism must be found to enable the Seed Unit organization and mission to evolve with that increasing need." To date there has been no definition of how that need should be met and indeed it is not apparent that there is general consensus on the nature and importance of that need within the CGIAR system.

The EMR report of 1984 states that, "There has been considerable debate over the years as to whether a research center such as CIAT should or should not be involved in fostering mechanisms to encourage the use of the products of its research." Presumably it is acceptable for the International Agricultural Research Centers (IARCs) to foster mechanisms to conduct further research at the national level. A question arising from this distinction is whether or not the IARC's effectiveness can legitimately be measured by what happens to agricultural development within countries if they do not engage in activities to foster the use of their products. The Impact Study (CGIAR 1985)* assumes that it is. Regardless of the debate on the role to be played in seed activities by the IARCs, a number of the IARC's have felt obliged to undertake seed technology activities recognizing that they represent a major constraint to dissemination and adaptation of improved genetic materials (See Chapter VI).

** CGIAR-TAC Report of the Second External Program Review of the Centro Internacional de Agricultura Tropical (CIAT). January, 1985.

Finally, the rather tenuous nature of the Seed Unit, because of the nature of its funding, requires that some definition be given of its future. Special projects have an "implied impermanence" or an implied conversion to a more permanent, financially secure status, (to the extent that any such programs achieve secure status). Special projects, and the commitments contained therein, require the appropriate analysis and institutional consultation to define their future direction and structure. The invaluable experience of the Seed Unit serves as an excellent base for such forward planning and design of seed development programs in LDC's.

In recognition of the possible evolving role of the Seed Unit, the EPR recommended that, "A study be done to determine whether the Seed Unit could best fulfill its functions as part of the CIAT core budget, by becoming a semi-autonomous unit, or by a combination of these or other possibilities. This is especially pertinent in regard to the necessary future international development activities of the Seed Unit and perhaps the whole CGIAR system." Reiterating the recommendations of the EPR, the EMR team "recommends that a study or studies be initiated as soon as possible to explore options for developing and adapting the unit into a more autonomous unit."

CIAT Response to EPR and EMR Recommendations

CIAT responded to these recommendations in the following statement, "The Panel recommends that a study be done to determine whether the Seed Unit would best fulfill its functions as part of the CIAT core budget or by becoming a semi-autonomous unit (or by a combination of these).

The Panel recommendation derives from the center-wide issue -which is raised in the case of the Seed Unit- of the inter-relationship of development-oriented activities to the more traditional role of the IARC's in research. CIAT has been concerned with this issue and welcomes the recommendation of the Panel to explore the possibility of a semi-autonomous status (as one alternative) for the Unit under overall CIAT patronage."

development. The other Consultant was familiar with seed program and industry development activities especially as related to project activities in some countries of Latin America.

In addition to information from the Seed Task Force, the Consultants, individually or together, met with officials in the World Bank, the Inter-American Development Bank, the United States Agency for International Development, Winrock International, Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT) and Centro Agronómico Tropical de Investigación y Enseñanza (CATIE). (Because of a schedule conflict attempts to meet with the Inter-American Institute for Cooperation on Agriculture (IICA) failed, but a telephone conversation and a subsequent telex from that organization provides their reaction). In addition, discussions were held with public and private sector representatives in six countries of the region. A questionnaire, Annex 1, was developed for use with people visited. The Study Team reviewed many documents provided by the Seed Unit, met with the CIAT Administration, the Seed Task Force, CIAT Commodity Program Leaders, and representatives of the CIMMYT Maize Program located at CIAT.

Terms of Reference

The terms of reference indicated that the Study should include:

1. The range of activities to be performed by the Seed Unit indicating those that are required, desirable and potentially needed for the rapid development of the seed sector.
2. The organizational options that can best meet the programs objectives.
3. The Seed Unit's evolving relationship with CIAT, the CGIAR system, and institutions outside the CGIAR system.
4. The links needed with national seed programs and industries.

CHAPTER II. ORGANIZATION OF THE STUDY

Objective

Based upon the EMR and EPR recommendations, the objective of the Study was not to determine whether or not a seed activity should be carried out at CIAT. Instead the objective was to define the future role and nature of the Seed Unit in most most effectively supporting; a) the development of the seed sector of the Latin American-Caribbean area; b) the CIAT Commodity Program's needs; c) the needs of the other Commodity Programs associated with other International Agricultural Research Centers (IARCs); and d) the international-national crop research network in the region, and the development of similar initiatives in other areas by the CGIAR system.

Method

To achieve the objectives of the Study, CIAT named an internal Seed Task Force consisting of representation from the administration, its Commodity Programs, and the Seed Unit. The Seed Task Force's purpose was to develop background material about the actual status and needs of the seed sector with a special reference to the commodities with which CIAT is concerned but not limited to those commodities. The Seed Unit assisted the Task Force by updating its material on the status of seed programs in each country in the region. Information on seed availability and the spread of improved varieties was collected on beans, cassava, maize, rice, sorghum and selected tropical pasture species. Discussions were held to review this information and to consider the needs of individual countries and how best to meet these needs. The results of the Seed Task Force's work were made available to consultants engaged to do the Study.

Two Consultants from outside CIAT were engaged to work with the Head of the Seed Unit to carry out the Study and prepare this document. One Consultant was quite familiar with the CGIAR system and agricultural

5. The cooperative activities needed and desired with technical assistance and donor agencies.

Points that were to be given special consideration included:

1. The consideration of the advantages and disadvantages of various operational arrangements.
2. The implications of funding for the Unit:
 - a. from within the CGIAR system through core, restricted core and transferred core special projects
 - b. from outside the CGIAR system.
 - c. for assisting the development of other units.
3. The Unit's relationship to the CIAT Board and management, the CGIAR system, donors, technical assistant agencies, seed enterprises, recipient countries and universities.
4. The implication of various alternatives especially with respect to the legal status within Colombia.
5. The nature of the structure of the Seed Unit of the future and its mandate.
6. The potential program activities and priorities for establishing and implementing them.

III. STATUS AND ACHIEVEMENTS OF THE SEED UNIT

Formation

The need for a Seed Unit at CIAT grew out of two overlapping problem areas that hampered rapid agricultural development based on improved production technology:

1. Limited availability of good quality seed of improved varieties.
2. Restricted adoption of new varieties emanating from research programs because many countries in the region had weak seed production and supply systems.

In addition, the Center saw the need to develop a more centralized support service for the multiplication, conditioning, and distribution of breeder and basic seed to backstop the Commodity Programs and national programs in the initial buildup of improved varieties coming from the joint research efforts. The Center had available the necessary conditions for hosting a successful seed effort: physical facilities for seed production, an extensive training infrastructure, expertise on seed-related aspects, and an international mode of operation.

The TAC External Program Review of 1977 stressed that training in seed technology should have a high priority in CIAT programs and be available to suitably qualified personnel of commercial seed producing enterprises. The CIAT management moved to meet this need and to establish a program to catalyze the development of adequate structures for seed activities in Latin America and the Caribbean. Assistance from the Rockefeller Foundation was requested to develop a proposal to be presented to interested donors for the creation of a Seed Unit at CIAT. The Rockefeller Foundation assigned an experienced seed specialist to CIAT for that purpose by October 1977 and, in addition to providing his salary and perquisites until other funding could be found, approved a grant for US\$25,000 to initiate these activities.

The proposed project was discussed with the CIAT Executive Committee in March 1978 and a few donors were advised of the project. In September 1978, the Swiss Development Cooperation (SDC) indicated interest in the proposal, and in November an agreement for a 5-year project was signed. The special project was initiated on January 9, 1979.

The Seed Unit operated during the past eight years with continued financial support from the SDC. The first phase was from January 1979 to December 1981. The second phase was for the period January 1982 to December 1983. During the third phase, 1984-86, the Unit has operated as a restricted core activity with SDC support.

Objectives

The original objective of the Seed Unit was to contribute to increased food production by accelerating the use of improved varieties through strengthening the seed production and supply systems in the countries in the Latin American and Caribbean region.

Specific activities to meet the objectives are:

To train personnel in government and private institutions, primarily from Latin American and Caribbean countries, in various aspects of seed industry and seed program development;

To extend technical collaboration to countries in the region interested in seed program development, with the aim of expanding the production of high quality seed of improved cultivars at all levels from the breeder to the commercial stage, with emphasis on, but not restricted to, the commodities with which CIAT works;

To conduct specific research in seed technology which is relevant to CIAT commodity interests and relevant to problems that collaborators at the national level are faced with;

To provide CIAT with a single unit to cooperate with Commodity Programs in multiplying, processing, storing, and distributing advanced experimental materials, or Breeder and Basic Seed, to collaborating countries for further multiplication; and

To disseminate information on seed activities, advances in seed technology, and the availability of promising materials in the region.

Program Activities and Achievements

Training and conferences. A combination of intensive seed production and seed technology courses; advanced, specialized courses; individualized in-service training; and thesis research have provided a range of training opportunities unique to the region. The Seed Unit followed a strategy in training at CIAT of tailoring seed courses to meet specific needs that supported the development of various elements of the seed sector. The advanced, specialized courses on breeder and basic seed production; seed quality and disease control; seed drying, conditioning, and storage; tropical pasture seed production; and seed enterprise management and marketing all represented innovations in seed training in the region. The facilities developed and the CIAT farm provided the Unit with the means to offer extended training with over 50 percent of the time devoted to field and laboratory activities --another unique opportunity for course participants from both the public and private sector. Table 3.1 shows the number of people trained by specialized topics by year.

Thirty-five in-service trainees were with the Seed Unit for a month or more to upgrade their capabilities in specific aspects of seed production and technology. Eight M.S. thesis research projects were completed and one Ph.D. program was finished. Most of these research activities were completed in cooperation with one of the Commodity Programs. The about trainees plus the course participants resulted in 566 people benefiting from training provided by the Seed Unit at CIAT during the eight years.

The importance of in-country training has always been recognized by the Seed Unit. However, the limited size of the staff of the Unit limited what was to be done. Nevertheless, in-country training was assisted by the Seed Unit's staff, in ways ranging from participation in courses organized by others to more direct organizational assistance

Considerable training was also assisted at the subregional level by working through the Central American Regional Technical Committee and the Regional Association of Seed Technologists for Central America, and the Caribbean (ARTES). In the Andean Zone, training was done in collaboration with the Junta Acuerdo de Cartagena (JUNAC). An agreement with the Centro de Estudos e Treinamento em Tecnologia de Sementes e Mudas (CETREISEM) in Brazil provided a mechanism to offer training especially for the Southern Cone. The in-country and subregional training provide the means to utilize some of the course participants from courses at CIAT and reach larger numbers of people with training focused on local needs. Table 3.1 provides information on the number of people trained in courses in which the Seed Unit staff participated. Several countries also conducted courses on their own or with the assistance of other agencies in addition to those accounted for in this Table.

Assistance to commodity courses included participation of the Seed Unit staff in short courses offered by the Bean and Rice Programs. In addition, staff members cooperated with the CIMMYT Maize and Wheat Programs on eight different occasions during the period to provide a one-week seed production and technology section in the regular production and breeding courses in Mexico.

During the eight years, the Seed Unit has gradually shifted to increase the number of advanced courses at CIAT, reduce the offerings of Intensive Seed Production and Technology courses and increase participation in in-country and subregional courses. Table 3.1 shows

these trends. Course participants came from 37 countries and 184 different private and public institutions. All courses were offered in Spanish, except two courses that were given in English and were especially for people from the Caribbean region. Table 3.2 shows the range of subjects covered through Seed Unit related training.

A survey was conducted on 297 former Seed Unit course participants who had been in at CIAT during the first three years of the program and their supervisors. Forty percent of the participants responded and some of the supervisors responded for people who did not themselves reply. All course participants returned to their jobs immediately after training and 94 percent were on seed sector activities at the time of the survey. Alumni found 70 percent of the course content to be highly relevant to their present work. The professional development of course participants clearly had been affected positively including greater credibility, increased appreciation of work and improved recognition and esteem. Communication with colleagues was reported useful by 93 percent of the alumni.

Eight workshops were held at CIAT under the sponsorship of the Seed Unit during the period. All of these workshops provided a forum for professionals with similar interests to exchange views and work together in developing plans, recommendations, and fresh approaches to help seed activities advance more rapidly. They contributed especially to the development of the seed network in the region.

In addition, assistance was provided to the Pan-American Seed Seminar and the Seminar for Seed Associations both of which were held at CIAT but largely financed by the Colombian Seed Producers Association, the Latin American Association of Seed Experts and the participants themselves. A workshop was held at CIMMYT in cooperation with ICRISAT, INTSORMIL and INIA of México on Sorghum Seed Production and Technology. Table 3.3 summarizes these workshops, the year held, the sponsorship and the number of participants. The staff of the Unit also participated in various workshops and seminars held at the in-country and subregional levels.

Table 3.1. Number of Training Participants by Categories 1979-86

	1979	1980	1981	1982	1983	1984	1985	1986	TOTAL
At CIAT									
Intensive Courses	37	30	30	49	23	32	34	20	255
Advanced Courses	-	26	31	29	34	59	29	69	277
In-country and Subregional	-	-	22	25	254	173	247	172	893

Table 3.2. Number of Training Participants by Course Subject 1979-86

	At CIAT	Outside CIAT
General	*[10] 255	*[5] 232
Breeder and Basic Seed	[2] 60	[1] 22
Organization and Marketing	[1] 32	[4] 110
Quality Control	[2] 60	[14] 299
Conditioning and Storage	[2] 56	[3] 70
Pastures Seed Production	[2] 54	
Rice Seed Production	[1] 15	
Small Farmers		[2] 48
TOTAL	532	893

* Number of courses in brackets.

Table 3.3. Summary of Workshops, Number of Participants and Sponsorship 1979-86

Workshop		Number of Participants	Sponsorship
Strategies, Planning and Implementation of a Seed Program	(1981)	39	CIAT
Seed Enterprise Management and Marketing	(1981)	78	CIAT
Training Strategies in Seed Technology	(1982)	49	CIAT
Improved Seed for the Small Farmer	(1982)	65	CIAT
Development and Projected Needs of the Seed Sector	(1983)	88	CIAT
Pasture Species Seed Testing	(1984)	20	ISTA-CIAT
Research and Training in Seed Production and Technology	(1985)	50	CIAT
Sorghum Seed Production and Technology Workshop	(1985)	127	CIAT, ICRISAT, INTSORMIL, INIA
Pan-American Seed Seminar	(1985)	253	ACOSEMILLAS*
Improved Seed for Small Farmers	(1986)	50	CIAT
Seminar for Seed Associations	(1986)	33	ALES*

* Held at CIAT and assisted by the Seed Unit

Technical collaboration

National level. The interaction with former course and workshop participants at the national level is a means for the Seed Unit staff to help them achieve goals and apply knowledge learned while at CIAT. Through visits, meetings, and correspondence links are maintained with many former course participants, leaders in national seed programs, seed associations, seed enterprises, universities, subregional groups and co-workers in sister International Centers and development agencies in the region. National seminars have been especially helpful in reviewing alternative policies and strategies and for encouraging the development of long-term plans.

Information on the status of seed programs in each country in the region was gathered and organized into country profiles during the first two years of the project. This information continued to be updated and a complete revision was made during the past year. Throughout the period, the Seed Unit staff worked to achieve as much cooperation as possible with not only the CIAT Commodity Programs but also those of CIMMYT, CIP and other IARCs with activities in the region to provide a more sharply focused CGIAR seed effort at the national level.

Subregional level. Initial work at the subregional level in Central America resulted in the formation of a Regional Technical Committee and a Regional Association of Seed Technologists in Central America around which training and seed development work could be focused. A seed section of the Annual Program Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios (PCCMCA) was organized by the Technical Committee with Seed Unit support. The Committee worked on publications of joint interest to the subregion. Long-term training plans were developed by these groups. An increased flow of technical information and the sharing of statistics on the status of seed supplies has occurred.

In the Andean Region, the agreement between the JUNAC and CIAT contributed to seed sector development in the region primarily through training. However, the Seed Enterprise Management and Marketing Courses

provided many opportunities for the participants to gain not only knowledge but also to develop new relationships that can help the exchange of seed within the region. A direct result of one of the courses was the formation of a Seed Association for the Andean Region (ARAS). JUNAC supported 11 training participants from the region in regular courses offered by the Seed Unit.

The collaborative agreement with CETREISEM in Brazil has made it possible to continue to exchange staff for training purposes. The Seed Unit has received three M.Sc. candidates from that program. The course offered at that location for the countries in the Southern Cone contributed not only technical information but also steps toward closer cooperation among seed programs in that subregion.

International level. In addition to the links mentioned previously with other IARCs in the Latin American and Caribbean region, the Seed Unit has contributed to developments outside the region. The Unit contributed to the development of a study and the formation of team to study the need for a Seed Unit type of activity in Africa organized by Winrock International for the IARC Directors and three donors interested especially in Africa. The Seed Unit supplied materials and shared information about the Unit with a seed specialist from the International Center for Agricultural Research in the Dry Areas (ICARDA).

A paper was developed for the International Center Directors on "The Role of the IARCs in Seed Research and Seed Sector Improvement." The paper is currently under review by the Directors and can become the basis for future seed activities by the IARC system.

Seed Multiplication and Supply. Developing stronger basic seed multiplication capabilities within each country is a primary objective of the Seed Unit. Basic seed is the vital link between breeder seed supplied by research programs and the producers of commercial seed. Similarly, the development of seed production and supply capabilities at

the commercial level are also a major objective. These aspects of the seed sector were assisted primarily through training and conference activities and technical collaboration.

The multiplication and sale of basic seed, or its equivalent, to national programs and the Commodity Programs of CIAT helps accelerate the next stages of seed multiplication at the national level and increases seed supplies for on-farm testing. This production is also of great value in the training programs. The Seed Unit does not produce or sell commercial seed to farmers. Over 300 tons of basic seed of beans (Phaseolus vulgaris), rice (Oryza sativa) and selected tropical pasture species (Andropogon gayanus, Stylosanthes capitata, Stylosanthes guianensis and Pueraria phaseoloides) has been sent to several countries in Latin America and the Caribbean during the period. The total value of this seed was approximately US\$320,000. Table 3.4 provides further details of seed supplied.

To respond to requests from seed enterprises and institutions potentially useful in-bred lines of publicly developed material of maize and sorghum are held in storage for those interested in utilizing them in their own hybrid development programs. Many of the materials are also used in training activities.

Seed multiplication of CIAT Commodities is done in cooperation with Station Operations and the Bean, Rice, and Tropical Pastures Programs. The seed may be grown by the Farm Operations Unit at Palmira or Quilichao, on land of the CIAT farm utilized by the Seed Unit for training or on land under the control of one of the programs. The production of pasture legume seed has been done recently under a contract system with carefully selected seed growers. Using a contract system makes it possible to select and evaluate production sites and growers with good potential, reduce production costs and to train future seed growers of the selected species.

Table 3.4. Seed Supplied during 1979-86 Period

Kind of Variety	Quantity (Kg)	Value (US\$)	Seed Consignee
<u>Beans</u> Varieties: 16 Lines : 38	17.667	34,584	Argentina; Colombia; Costa Rica; Cuba; Dominican Republic; Ecuador; Guatemala; Haiti; Honduras; Nicaragua; Perú CIAT's Bean Program, Cassava Program, Farm Operations Unit, Phosphorus Project.
<u>Rice</u> Varieties: 6 Lines : 5	274.154	176,141	Belize; Brazil; ICA, J. Janne, Colombia; Honduras; Panamá; CIAT's Rice Program.
<u>Tropical Pastures</u> Grasses : 2 Legumes : 5	10.073	110,153	Bolivia; Brazil; ICA, Hacienda Llano Grande, Hacienda Las Lomas Semillas El Aceituno, Colombia; Cuba; Guatemala; México; Nepal; Panamá; Perú; Venezuela; CIAT's Tropical Pastures Program.
<u>Maize</u> Line : 1	881	749	CIAT's Bean Program, and Farm tions Unit.
Grand Total	302.775 =====	321,627 =====	

The seed drying and conditioning facility is utilized for training, handling the above production and to provide a service to the Commodity Programs, ICA and local seed enterprises. Income for this service has covered the operational costs including the cost of the extra laborers and technicians needed to handle the production, drying, conditioning and quality control work. A rotating fund on seed conditioning is utilized to handle such income and expenditures. The dispatch of the seed is arranged in cooperation with the Supplies Office.

The seed testing laboratory offers a service to the Commodity Programs for seed quality evaluations. The Tropical Pasture Program is utilizing the laboratory extensively with staff working in the laboratory to handle research and routine testing from their seed research and production activities.

Research and Development. The Seed Unit gave research a relatively low priority during the entire period because of the need to more adequately apply what is already known, especially on the cereal crops, and in several aspects the Unit has no comparative advantage over other institutions. The research that was done is linked to one of the CIAT Commodity Programs (See Annex 2).

Six Visiting Scientists from North America and Europe contributed to the adaption of existing technology for application to the seed problems of the region. They worked especially in the areas of seed quality control, training and conditioning.

These research activities provided an important mechanism solving problems of current concern in the region and transferring technology into the region from outside to help accelerate adoption. The location of postgraduates from the region and Visiting Scientists from the developed world at the Seed Unit promotes an important scientific interchange that is valuable to both parties.

Information and communication. The Seed Unit's objective is to use information and communication activities as a tool for rapidly strengthening the integration of the seed network and to accelerate the adoption of technology that can make the seed sector more effective. Specific activities have centered around publications, audiotutorials and network development.

Publications. Publications that relate especially to network development include a Directory of Seed Specialists and Institutions in Latin America and the Caribbean, a Seed Science and Technology Thesaurus and a Glossary of Terms Used in Seed. The translation into Spanish and widespread use of Successful Seed Programs: A Planning and Management Guide has supported training activities and helped leaders in the region in the organizational and management aspects of their programs. The publication Metodología para Obtener Semillas de Calidad - Arroz, Frijol, Maíz y Sorgo has contributed to the technical integration of concepts on varietal description and basic seed production.

Proceedings of all workshops have been printed except the last two which are ready for printing. These publications have considerable value for those people who did not attend the workshop and to help organizations involved in implementing the recommendations and proposals that came for the event. The workshop proceedings available or soon to be available are:

- Strategies, Planning and Implementation of a Seed Program
- Seed Enterprise Management and Marketing
- Training Strategies in Seed Technology
- Improved Seed for Small Farmer
- The Development of the Latin American and Caribbean Seed Sector and Projected Needs
- Seed Research and Training
- Improved Seed for Small Farmers

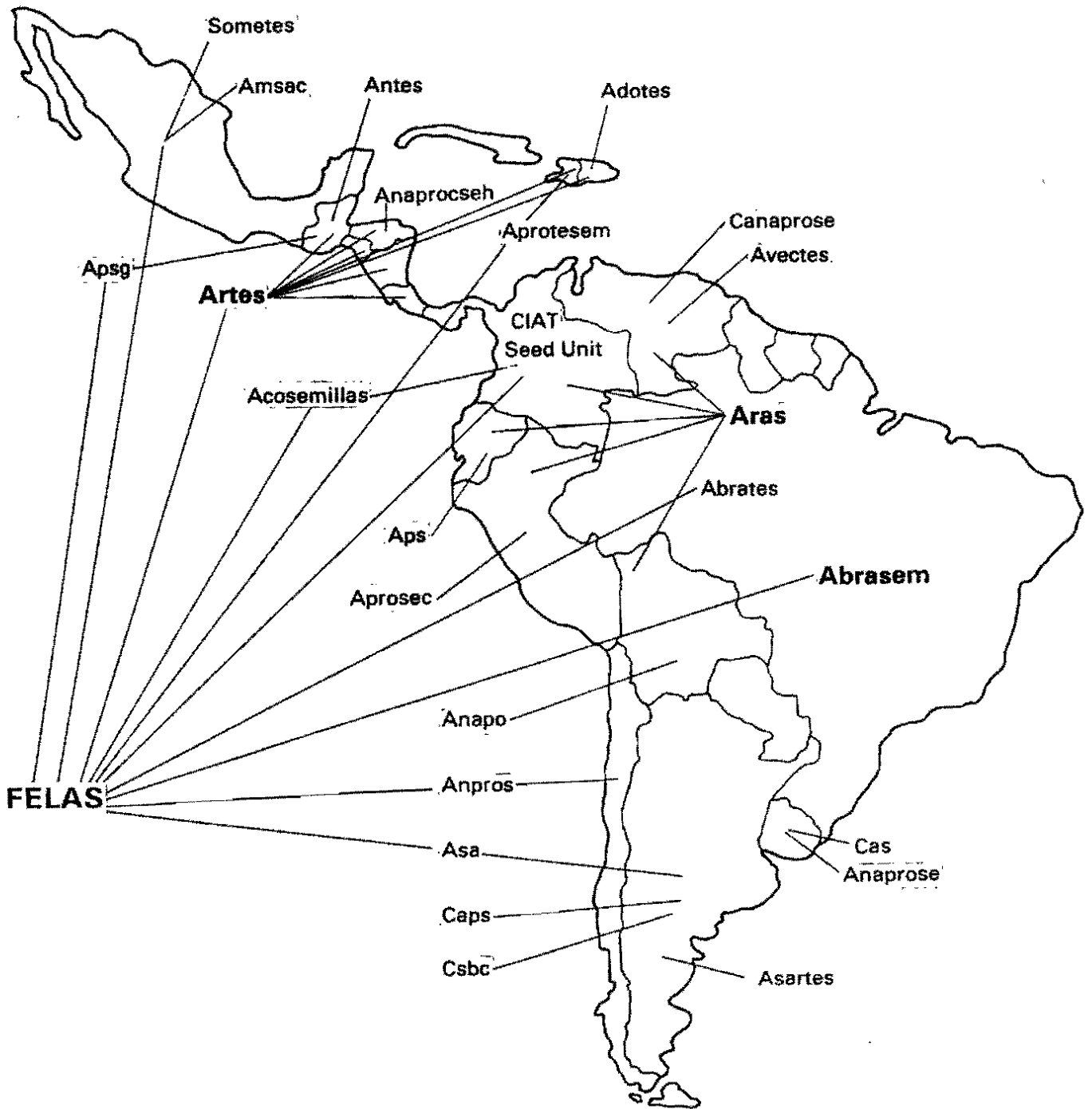
The newsletter is published every four months and distributed to about 1,500 people. It is designed to provide current information about seed related events in and outside CIAT, to provide technical information of practical value to readers, to keep people informed about new seed publications and sources of information and to highlight achievements of individuals, organizations and associations.

A book written by Latin American seed specialists on Seed Production and Technology is in the first and second draft stage. When completed, it will be valuable for training purposes especially at the university level and in short courses offered within countries.

Audiotutorials. The preparation of audiotutorial units provides the means to assist training at the in-country and subregional levels especially and to help standardize many procedures and concepts throughout the region. As English versions are prepared, some of these units have value in similar programs outside the region and provide a way for the Unit to assist indirectly in those areas. Audiotutorial units on seed production and technology developed by the Seed Unit, the Commodity Programs and/or jointly and that are available are given in Annex 3. Seven other audiotutorials are in the process of preparation.

Seed network development. Within each country seed network development is necessary for success. But this network must link effectively with the crop research network being assisted by the Commodity Programs of the International Centers. In several countries a critical mass of seed sector personnel exists, but the need is to help them form a functional network with linkages to research activities. Seed technology and trade associations are one mechanism that can assist network development. Associations have been formed in many countries as shown by Figure 3.1 Sixteen of these associations have been formed since the Seed Unit was started. A pressing need is to help these associations develop leadership and meaningful program activities.

Figure 3.1. Regional Seed Association Network



One role of the Federation of Latin American Seed Associations (FELAS) is to foster and encourage these national associations which are becoming members of this federation of associations. (The Latin American Association of Seed Experts (ALES) changed its name in 1986 to FELAS). The Seminar with the leadership of associations held in cooperation with ALES, now FELAS, contributed to the strengthening of this seed association network.

The seed network at the sub-regional level continues to be assisted by ARTES in Central America and the Caribbean as reviewed earlier. The formation of ARAS in the Andean Zone offers the potential of similar benefits in that area. Complementing these sub-regional associations are the more official links that need further strengthening. These include: 1) the Regional Technical Committee for Central America and Panamá, 2) a proposed Regional Technical Committee for the Andean Zone and 3) the working relationship with CETREISEM in Brazil which is developing links within the Southern Cone.

The regional seed network embodies the people at the national level. Figure 3.2 illustrates this network as it relates specifically to CIAT trained people in National Seed Programs. Of course, the actual network includes many more people than have been in CIAT courses.

The fourth segment of the seed network includes universities that have strong seed technology and production training and research. Fifty-five staff members from universities participated in Seed Unit courses at CIAT during the period. Six of the people contributing chapters to the seed technology and production book are from institutions in this network.

Personnel

Seed Unit permanent staff. The staff of the Seed Unit gradually developed from a Head and a Secretary to its present composition of a Head and one other Senior Scientist, six Junior Scientists, two Secretaries, four Technicians and seven Laborers.

Figure 3.2. National Seed Program and Training Participant Network¹



¹ Total number trained by country, 1979-1986 illustrated

Research Fellows, Visiting Scientists, and Consultants. The Seed Unit has used Research Fellows, Visiting Scientists, and Consultants and guest lecturers to complement the permanent staff. The approach is used because the permanent staff is small and the flexibility provided opportunities to utilize recognized leaders with just the right experience and knowledge for a particular task. These 30 specialists added 496 weeks of personnel time to the Seed Unit's staff time or the equivalent of nine and one-half years of time. In addition to these longer-term appointments, the Unit received considerable collaboration from many in the Commodity Programs and other Unit staff members of CIAT. Staff members of CIMMYT, CIP, ICRISAT, and INTSORMIL have also collaborated.

Other specialists and organization within Latin America as well as outside contributed to courses and the achievement of the Unit's objectives. Especially among these are: the Instituto Colombiano Agropecuario (ICA), Colombia; seed enterprises in Colombia, Brazil, Costa Rica, Ecuador and Perú; Mississippi State University often with financial assistance from USAID; the International Fertilizer Development Center; the International Executive Service Corps; the International Seed Testing Association; Oregon State University, Iowa State University, and Ohio State University. Integrating assistance from outside the Unit to help meet program objectives has required a high level of cooperation, coordination and goodwill. Yet, this approach has greatly helped the rapid development of the Unit, added to its professionalism, contributed to its integration in the region and with the IARC Commodity Programs, and made it possible to achieve much that could not have been done without this broad base of support.

Financial Aspects

The Swiss Development Cooperation contributed over US\$5.6 million to the capital investment and operational costs of the Seed Unit during the eight years for an average of US\$700,000 per year. Table 3.5 shows budget and yearly expenditures.

Table 3.5. Seed Unit Budget and Expenditures by Years from 1979-1986

A M O U N T (US\$)									
YEAR	1979	1980	1981	1982	1983	1984	1985	1986	TOTAL
Budgeted	636,700	593,000	690,600	695,380	738,350	752,466	761,718	769,816	5,638,030
Expenditures	176,629	818,218	826,832	741,239	757,087	684,695	776,921	780,129	5,561,750

In addition to these expenditures, CIAT contributed two buildings, formerly a part of the Beef Field Unit, which were remodelled to provide office, laboratory, training, seed storage and bag drying space. Seed storage bins, existing at CIAT were relocated and linked with a new seed conditioning facility built under the project. This shift and related modifications also improved the grain handling capability of the Farm Operations Unit. Some equipment suppliers from North America loaned equipment and discounted some items to help stretch project dollars for equipment as far as possible. Among the major contributors in this manner were Blount Agribusiness International, Gustafson International, CEA Carter International and Seedburo Equipment Company. Other major contributors financially directly or indirectly were the Rockefeller Foundation, the German Foundation for International Development, Mississippi State University/ USAID, the JUNAC and the Caribbean Food Corporation. (The latter two supported trainees and courses with funds from the EEC). These total financial contributions amounted to approximately US\$500,000.

In addition to the above support, the salary of many specialists that was not paid for out of the project but carried by their employer and mentioned earlier in the staff section should also be added. No attempt has been made to stipulate this amount because of the many people involved. The value of those contributions is not included in the totals mentioned.

Current Status

Program plans have been developed for 1987-88 without major changes in the activities of the Unit. Some reduction of training activities at CIAT is expected and an increase in in-country seed program development. The staff strength is projected comparable to its present level.

The budget for the Seed Unit is included in the core program of CIAT for the years 1987-88. The SDC has agreed to support approximately two-thirds of the 1987-88 budget as a restricted core contribution. The remaining one-third of the funds will come from the core funds.

The facilities of the Unit are adequate to meet current operations except for minor modifications. The administration of CIAT is actively searching for a new Head of the Seed Unit with the planned semi-retirement of the present Head. Continued short-term assistance from the current Head of the Unit is planned.

CHAPTER IV. COMPONENTS AND LINKAGES IN VARIETAL AND SEED IMPROVEMENT

Introduction

The work mandate of the CGIAR's agricultural research centers (CIAT among them) is to increase food production on a worldwide basis, particularly in the developing countries. This is achieved by breeding of new plant cultivars and their subsequent transfer to national programs. For optimal results, new varietal materials must be managed in the context of local agronomic conditions and practices.

To meet this objective comprehensive strategies have been developed, according to the species involved. As a starting point, germplasm banks have been created which allow not only the selection of base materials, but also the screening of materials needed for the more complex genetic combinations required in the breeding programs. Obtaining a new cultivar with higher production and quality potentials, is a responsibility shared by a group of professionals engaged in closely linked activities (genetic, physiological, microbiological and entomological aspects, agronomic and economic).

Once the superiority of the new cultivar has been established, it is then released for use, in one or several of the target countries. i.e., it is offered to those who have the responsibility of reproducing it. Sometimes, the dissemination of cultivars is the responsibility of the public sector, although the private sector may be also called upon to play a role in it. From our point of view, releasing a cultivar does not consist merely in naming it but also involves the maintenance of minimal volumes of basic seed to be supplied to those responsible for agricultural production.

Behind the release of a new cultivar, the hope exists that it will replace or complement traditional cultivars, the sooner the better. For this to happen, harmonious link must exist between the breeders' goals and the constituent factors of agricultural production - the needs of farmer in the first place.

Farmers' Adoption of a New Cultivar

The final success of the breeders' work is, without a doubt, the large scale adoption by farmers of the newly released cultivar. However, this link between science and practice is not always obvious. Farmers' adoption of a new cultivar depends on several factors, particularly on those related to the specific properties, or direct merits of the new cultivar, e.g., higher productivity, resistance to specific pests or disease, etc. But, at the same time, and in spite of a series of positive aspects, the new cultivar may not reach the production level. It may happen that its adoption becomes stagnant for causes that have no relation to the production process itself, as would be the case of some political decisions or the failure of the public or private sector to multiply the new variety and distribute it. It is obvious that, under these circumstances, breeders share little responsibility in what happens to the dissemination of the new cultivar.

When there exists a concrete willingness on the part of the official sector and, also, governmental policies favor the adoption of this new cultivar at the production level and farmers are satisfied with its characteristics, then why doesn't the cultivated area increase? Many times the bottleneck is the seed flow.

The seed flow depends on two essential elements, the first is the viability of the seed, from harvest to subsequent planting; the second - managerial in nature - refers to the people who are responsible of basic, registered, certified seed production, i.e. who they are and how the process of seed dissemination is being carried out.

Seed viability is one aspect in which the breeder bears direct responsibility, as he is supposed to have taken into account all those aspects that could influence the productivity of a new cultivar - from planting to harvest. During the process of creating a new cultivar, he has had to consider all the elements that affect seed quality, from the pre-harvest stage to the planting stage.

In relation to the organizational aspects of the seed flow, plant breeders should be in a position to offer leadership and support for the establishment of a seed flow (be it basic or commercial seed) which will lead ultimately to the farmers' fields.

Both the preservation of seed viability and the organizational aspects required for securing an harmonious flow of seed must be taken into account by the teams of breeders working in research centers where new cultivars are produced, as they bear a responsibility for the economic and social returns of the high costs of research.

The Seed: A Live Element that Deserves Particular Attention

It is in the seed where the genetic potential and the survival potential can be found together, i.e. the life of a specie. Good seed, usually known as quality seed, is that which is intact - in all its physiological aspects - at the time of its formation, and that which does not disseminate, from the time of harvest, pests and/or diseases that could harm - during the cropping phase - the expression of the total production potential that it is able to transfer. The production of good quality seed depends on several factors manifesting their influences through the cropping, the conditioning, and the storage stages, up to the time the seed is used.

It is worth noting some particular aspects of the productive process taking place in a seed producing field, as distinct from that of a common crop ultimately destined for consumption of its end products. In the first place, cultural techniques used for obtaining high yields of good quality seed can, or should be different. In some instances,

plant density must be lowered to allow the expression of the reproductive potential - forage plants, potatoes -. Also, consideration must be given to the management and nutritive aspects - minerals, water, nitrogen, minor elements -; to irrigation frequencies; weed control and phytosanitary aspects; to the use of pesticides that will not harm seed viability; and to the use of preharvesting defoliators. Finally, harvesting techniques must be adapted to avoid physical or physiological damage to the seed - hand versus mechanical harvest; spread of harvester drum; speed at transferring the seed from the fields to the conditioning centers.

Harvested seed must undergo a series of treatments - pre-cleaning, drying, cleaning, classification, disinfection, and/or other special treatments up to the moment it is packaged. All these operations are aimed at preserving the viability potential of the seed. Rapid drying could be detrimental to some species. Cleaning with a pro-gravity flux and excessive drop force could harm the seed. Sometimes, it becomes necessary to cause changes in the external morphology of the seed to facilitate its use.

Storage is a key point and requires a great deal of knowledge about physiological processes in the seed. Low storage temperatures and humidity are critical to maintaining high viability.

If the farmer is to receive good quality seed, it is important to consider the type of package that will contain the seed through the channels followed by the seed from the moment it is produced until it is distributed.

Component Parts of the System Required for Seed Production

At the International Center for Tropical Agriculture (CIAT), activities are divided by specific Commodity Programs; cassava, rice, beans, and tropical pastures. The objective of the work is to obtain new and/or improved cultivars.

There is a general consensus that final success of the research activity is measured by extensive adoption of new cultivars by the production sector, or by one or many countries or regions. For this to happen, aspects related to seed production must be considered during the breeding process. Therefore, programs should be designed to integrate the seed technology aspect within the process of creating a new cultivar.

In most situations, the total process of varietal development and adoption is not viewed as a continuum requiring close linkages among individuals, among programs, among activities and among institutions. As a result, there are serious gaps and conflicts that arise in national systems. Responsibilities are not clear, functions are duplicated or totally ineffective with the result that seed quality or quantity is not delivered. Interaction among agencies and between the public and private sector institutions is frequently non-existent or even competitive. We believe that the Seed Unit can be instrumental in assisting agencies in gaining a better understanding of the totality of the process of seed production and management.

Figure 4.1 attempts to illustrate the events and linkages in the process of seed production and adoption. Table 4.1 is an elaboration of the various activities as shown in Figure 4.1. In addition, the Table attempts to define where the various functions are performed and by whom.

The development of successful seed industries in countries of the region requires that the various activities in the process be strengthened. Plant breeders should work closely with seed specialists to assure that basic seed is properly maintained and multiplied; that new materials perform adequately as seeds and that varietal characteristics are maintained. The functions of the seed specialists in the Seed Unit should be to strengthen the national program activities in each of the areas of responsibility including assistance in helping to establish the linkages at each step in the seed process.

Figure 4.1. Current Parts and Activities of a Typical Seed System Illustrating the Linkages and Flow of Activities from Germplasm Accession to Varietal Adoption

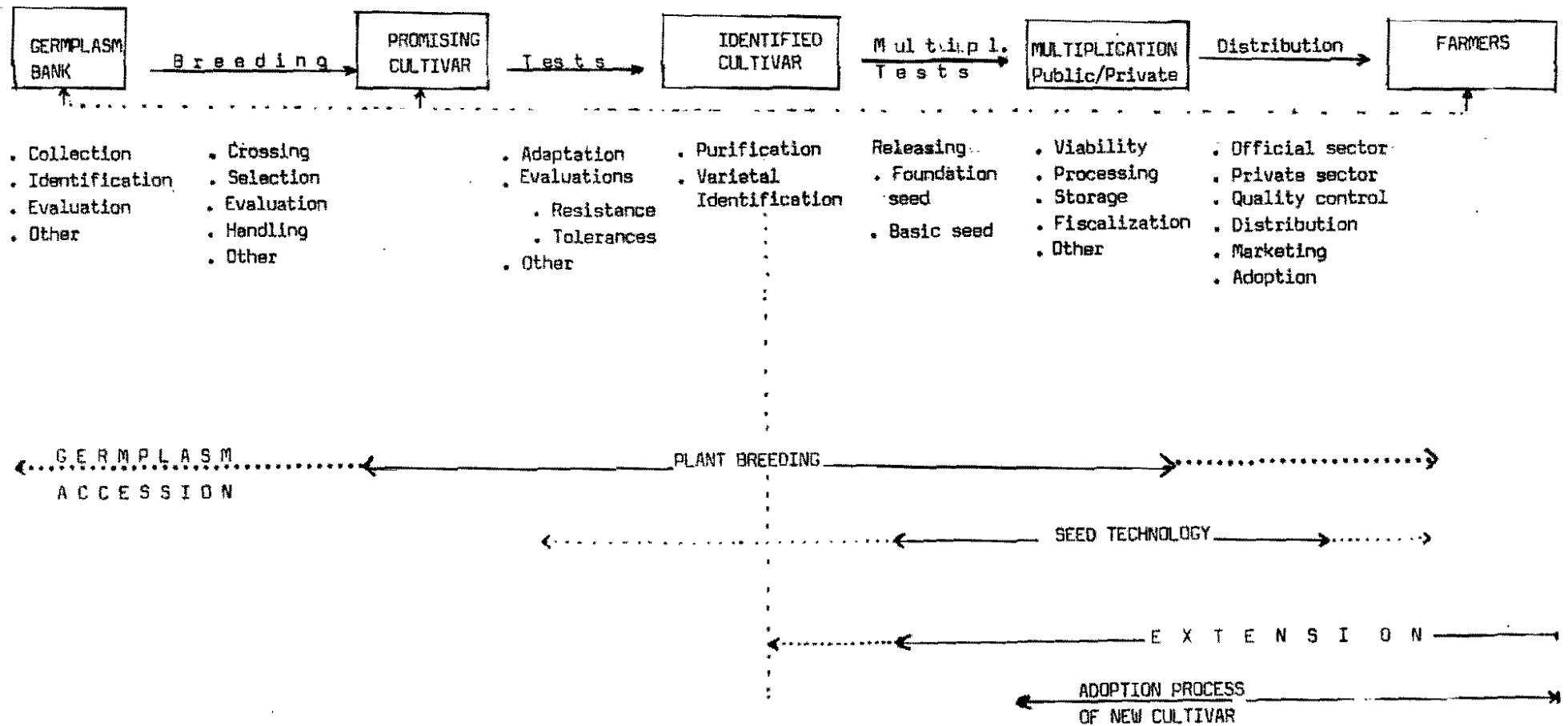


Table 4.1. Activities and Responsibilities from Germplasm Collection to Seed Use by Farmers

Activities	Description of Activity	Responsibility
Germplasm Collection and Conservation	Assembly and use of germplasm from national and international sources.	Public sector - National and International sources.
Plant Breeding	Crossing, selection and development of improved varietal material.	Public or private sector - National Research Service (NARS), International agencies, seed enterprises.
Experiment Station and On-farm Evaluation	Assessment of potential varietal material under different conditions to determine merit.	Public NARS but the private sector may participate or do evaluations of its own material and assist public evaluations.
Breeder Seed Purification, Multiplication and Maintenance	Initiation of seed increase phase and maintenance of supplies for further multiplications.	Public - National Agricultural Research Service. Private - Individual enterprises with own research capability.
Release Process	Assessment of results of evaluation, consideration of varietal description, naming, and decision to release	Public - Initially the breeder of the variety and crop research program. Subsequently, a National or State Variety Review and Release Committee. Private - Private breeder with concurrence of management material may be subjected to National or State Variety Review and Release Committee.

Table 4.1 Continued

<p>Basic Seed Multiplication, Conditioning, Allocation and Distribution</p>	<p>Key link between Breeder's seed and seed for further multiplication, commercial stage. Seed growing, drying, conditioning, storage, allocation and distribution.</p>	<p>Public - National Agricultural Research Service individual crop research programs, or a Basic Seed Unit linked to the NARS or NARS and cooperating seed growers and enterprises. Private - Section within seed enterprises with this responsibility primarily for material developed by private research.</p>
<p>Commercial/Certified Seed Production, Conditioning and Storage</p>	<p>Growing of seed on own farms or by contract with farmers, quality control, drying, cleaning, grading treating, storage and marketing.</p>	<p>Public - Facilitate availability of credit, equipment and spare parts; tax incentives to stimulate private participation. When direct activities are undertaken, preferably jointly with private sector, as autonomous enterprise. Private - Seed enterprises, by cooperatives, private individuals or partnerships and various small farmers seed growing/selling systems.</p>
<p>Internal and External Quality Control*</p>	<p>All steps needed to assure good seed quality including: verify seed sources, field supervision and inspection, timely harvest, care to avoid mixture and damage in conditioning, proper storage, seed testing and monitor quality through sales.</p>	<p>Public - Seed legislation, certification, testing - external quality control. Private - Seed enterprises and small farmer seed growers/sellers - internal quality control.</p>

* Quality Control is an integral part of many of these steps.

Table 4.1. Continued

Information and Education	Field demonstrations, field days, publications, radio, TV, meetings.	Public - NARS to provide information to extension workers and seed sector - Extension to communicate with farmers. Private - Complement extension effort in communicating with farmers
Marketing	Determining needs, accumulate supplies promotion, distribution and trade.	Public - Provide background information on seed marketing to private sector and to autonomous seed enterprises or marketing groups. Private - Major responsibility for developing effective marketing systems.

CHAPTER V. STATUS OF SEED SYSTEMS IN LATIN AMERICA AND THE CARIBBEAN

Introduction

Seed development was underway in Latin America and the Caribbean in the first half of the 20th. Century. References are made to the participation of Argentinian seed specialists in the early meetings that resulted in the formation of the International Seed Testing Association (ISTA) in 1924. However, the most significant advances were made in the 1950s when Argentina and Chile were developing the essential components of their seed programs and the private sector in these two countries started to move with hybrids of maize based largely on germplasm for the USA. At the same time, Brazil made the decision to concentrate on the development of its seed sector and, among other support, obtained the assistance in the late 1950s from Mississippi State University through the financial assistance of the United States Agency for International Development (USAID). The Brazilian program included considerable training while simultaneously moving to determine the most appropriate role to be played by the public and private sectors.

At about the same period Colombia, Costa Rica, El Salvador and México started to improve their seed sectors. The initial efforts of Colombia, Costa Rica and México concentrated primarily on the development of public sector enterprises to produce and supply seed to farmers. Subsequently, all of these programs opened possibilities for the development of the private sector. El Salvador developed an active private sector initially based on hybrid maize, and was successful in supplying hybrid maize seed to thousands of small farmers. Peru initiated a hybrid maize seed program, through the efforts of the University of La Molina and a few seed producers in the region, with a focus on the most productive coastal areas. Venezuela also started a hybrid maize seed program with four or five local companies playing a dominate role.

Hybrid sorghum seed started to be imported into the Latin American and Caribbean region in the 1960s. The region relied largely on imported vegetable seed from the USA and Europe. By the late 1960s and the early 1970s larger quantities of improved rice and wheat varieties started to be introduced into the region and the development of a rice seed industry started in a few countries, especially Colombia and Brazil. Improved wheat varieties stimulated greater commercial wheat seed production in Chile, Argentina and Southern Brazil during this period. Small efforts in the other countries of the region contributed to the seed sector, but most of these countries were not able to organize an effective seed production and supply system either in the public or private sectors. In general, the countries in the Caribbean region relied on imported seed and a few introduced varieties during the 1950 and 1960 periods with little development of the seed sector.

By the 1970s the plant breeding research effort had gained strength in a number of countries and the international agriculture research system was underway to further assist these efforts. Thus, by the end of the 1970s wide differences existed among the countries in terms of the development of their seed sectors. Argentina, Chile, Brazil and Colombia had most of the elements needed for their seed sectors to develop with rather dynamic private seed sectors. By this time, the public sector initiative in México was making substantial contributions, but was not able to satisfy all of the demand for improved varieties. The private sector began based on largely hybrid sorghum and vegetable seeds. The "Patronatos" in Northern México were making a significant impact with the spread of improved wheat seed. Most of the other countries in the region had made some progress, but had not been able to organize significant seed systems that could move the required quantities of improved varieties to farmers. It was in this setting that the Seed Unit at CIAT started to assist the development of the seed programs and industries in the region.

Current Status

The Seed Unit staff with the assistance of consultants developed a "Country Profile" for each country in the region by 1980. These country profiles included an assessment of each component of a seed program and gave a numerical score of one to four to these components. Figure 5.1 provides a description of each of the levels. The components evaluated included: goals and policies, variety development capability, initial seed increases, commercial seed production, quality control, extension and marketing, personnel development and leadership. In 1986 a similar assessment was made of each of the programs based upon information provided to the Seed Unit by the national programs, trip reports of the Seed Unit and CIAT staff members, information from course participants and the views of the current Seed Unit staff.

In summary, Figure 5.2 shows that only thirty percent of the countries of the region have achieved the accelerated to well developed category, while 70 percent are still in the initial to early stages of development. It must be recognized that these percentages, on a country basis, do not reflect the status by cropped area or of seed produced. Many smaller countries make up the lower end of the scale.

Comparisons were made between the status of the seed sector in each country in 1980 and the status based on the 1986 evaluation. Direct comparisons could not be made for all countries, but the results show that five countries made significant progress during the period, thirteen countries made meaningful progress while two countries had not progressed enough to reflect changes in the basic status of their programs, and two smaller countries actually received lower scores than they had in 1980. Significant progress has been made, but the rate of progress is still far short of the potential that exists in the region for the accelerated development of the seed sector.

Figure 5.1. Categories of Development

Stage of
Development

- 4
Well Developed. Components fully developed and seed sector having significant impact.
- 3
Accelerated Development. Components and whole seed sector growing and operating effectively.
- 2
Early Development. Components of program already identifiable and functioning.
- 1
Initial Development. Some components of seed sector starting to operate.
- 0 _____

Figure 5.2. Development Status - Percentage of Countries in Each Category Latin America and the Caribbean - 1986

CATEGORY	PERCENTAGE OF COUNTRIES*
3.1 - 4	5
2.1 - 3	25
1.1 - 2	45
0 - 1	25

* Brazil was divided by States

Constraints

The leadership of many countries expressed concern about not having adequate supplies of good quality seed of improved varieties. Yet, it continues to be difficult for some governments to translate this recognition and interest into clear goals, strategies and policies that can be continued long enough to make a significant impact on the development of the sector. In the past the early attempts to form public sector seed enterprises actually worked against dynamic development of the private sector. Today, practically all of the countries of the region recognize the value of the development of the commercial seed industry in the private sector while the public sector concentrates on varietal improvement, supplies of breeder and basic seed for further multiplication by others, quality control, and supporting extension activities. Some countries have been able to develop the means, often through special projects, to assist the development of some aspects of their seed programs. However, many countries still do not have clear goals and mechanisms to stimulate the development of their private seed sector, especially the development of small farmer seed multiplication and supply systems.

Linked with the above constraint is the need for the consistent availability of basic seed of improved varieties coming from the public sector research programs. Private seed enterprises with their own research programs multiply their own basic seed, but this applies primarily to hybrids of maize and sorghum. Many private enterprises even with maize and sorghum rely upon the public sector for basic seed supplies. In the case of most of the other crops in the CGIAR system, the public sector has a major responsibility for this activity and the supply is often inadequate.

Another constraint in some countries is the lack of an economic incentive for multiplying and/or selling seed. There are many reasons for this. One of which has been the actions of governments to set the price for seed without taking into account all the costs of production, the risk, and the need for profit that must be considered if the private sector is to be interested.

Difficulties in developing marketing systems that can reach the vast numbers of small farmers has limited the seed sector to the most viable potential customers. Thus, the seed sector has limited itself to those markets that it could reach easily and economically.

Prior to the start of the Seed Unit very few opportunities existed for personnel to be trained especially for work in the seed sector. Universities generally did not include this subject in their curricula. The notable exception was the Brazilian program that provided for many degree possibilities outside the country and a major training effort within the country. Even with the 555 people trained at CIAT during the past eight years, the needs of the seed sector for better trained and motivated people is enormous. Many countries have not recognized this need or developed effective training programs within their own boundaries.

The availability of improved varieties that are truly superior as evaluated by the farmer is a constraint in some locations --improved varieties do not exist for all crops in all locations. A constant flow of improved varieties from the crop research programs does not exist in many countries. It is difficult for the commercial seed industry to develop and grow without the constant infusion of new varieties for sale.

Public Sector Development

In the initial stages, the public sector normally must lead the development of the seed sector. The history of the growth of the seed sector in the region reflects this fact. The problem that has existed in country after country is the difficulty of national governments playing a leadership role while allowing for private initiative to emerge. While there is a need for complementarity in these relationships, it is sometimes difficult to maintain a proper balance. Today, financial constraints cause governments --both in developed and developing countries-- to examine more carefully their role in seed sector development. This financial reality is probably a very healthy

development and for the good of the long-term development of the seed sector. In the short-term, it sometimes causes difficulties as programs try to break out of old models.

The public sector tends to concentrate on variety improvement, breeder and basic seed production, quality control and extension activities in most countries in the region. The production and sale of certified and commercial seed is largely the responsibility of the private sector. Countries that started public sector seed enterprises are attempting to cause these units to be totally self-supporting, so they do not represent a financial drain on the public sector. Consideration is being given to selling or leasing some of these units to the private sector in two or three countries as a way of gradually shifting responsibility from the public sector. Many public sector programs could be improved by gradually converting the basic seed activities and the seed certification programs into financially autonomous activities with the support and encouragement of the commercial seed industry and farmers. A few programs have achieved this goal and some others are beginning to consider how they could make this transition.

Private Sector Development

The commercial private sector including the multinationals has developed more vigorously in some countries than others for various reasons. A major contributor to the development of the private sector in seed production and supply has been clear governmental policies that encourage this development, the availability of improved varieties and basic seed of those varieties on a regular basis, and economic incentives. When this combination exists, the private sector has normally made the investments needed to enter the commercial seed business. It has tended to concentrate on those crops that are most profitable. Thus, some crops continue to be neglected. It is for this reason that some countries are starting to try to find other models to help multiply and sell seed of crops such as beans and varieties of maize through various kinds of local, small farmer production and supply

systems. These efforts are formed as family operations, cooperatives, associations and other small organizational arrangements. Most attempts of this kind are in the private sector, but with considerable public sector technical assistance and encouragement. The advantage of these initiatives is that the cost is relatively low for the public sector and they provide a broader base for seed production and distribution.

An indication of the vitality of the private sector is often reflected by the existence of seed grower, processor or trade associations. Fourteen countries in the region have associations of this kind that are functional at the national level. In addition, Brazil has several state level associations of this nature. A listing of the national seed associations of this kind is given in Annex 3. In addition, a regional association exists in Central America that includes both commercial seed industry and non-commercial seed technologists. A regional federation of Latin American seed associations has recently been formed that includes both kinds of membership.

Past and Current Technical and Financial Assistance to Seed Activities

Technical assistance was started in the 1950s with contributions from FAO and through a USAID contract with Mississippi State University (MSU). The first training course offered by MSU in the region was in Chile in 1955. From that date forward the MSU/USAID program sponsored several training courses throughout the region. FAO at one period in the 1960s had three people working on a regional basis on seed activities. The major country project, mentioned earlier, was the MSU/USAID activity in Brazil that spanned a period of more than 10 years from the early 1960s to the beginning of the 1970s. This project was followed by a large IDB project in the mid-1970s to assist the development of the seed sector in that country.

As is stressed in papers by Fuster (1981) and Ampuero (1982), the IDB has assisted seed activities from 1961. Often this support was a part of a larger project on research, extension, or rural development. A number of specific seed program projects were also developed such as

the one in Brazil. Throughout the period assistance of one kind or another through the IDB was provided to Brazil, Panamá, Colombia, Ecuador, El Salvador, Honduras, Paraguay, Haiti, Perú, Costa Rica, Guatemala and the Dominican Republic. These investments in the seed sector by IDB amounted to over US\$70 million. The World Bank (IBRD) has financed seed activities in many countries around the world with expenditures at the US\$20 million level. In Latin American and the Caribbean their support has been limited to a special project in Ecuador and support for seed linked to other projects in Brazil and Haiti. USAID has assisted individual country projects with capital investments and training. Information on specific countries and the amount spent is not readily available. A few other bilateral donors have assisted a few seed activities but the details on these rather minor project activities are not available.

During the past eight years, support to new seed projects has been started in Panamá, the Dominicana Republic, and Guatemala with IDB support. Some support for seed activities has been incorporated into other projects by the IBRD, the IDB and USAID. The USAID's major country project was in Bolivia through a contract with CHEMONICS. The Swiss Development Cooperation has assisted a pasture seed production project in Bolivia and smaller activities in one or two other countries. FAO has concentrated on the support of three or four in-country training courses of two to three weeks duration each year. They have also sponsored three or four regional seed training courses during the period. Most of these courses are reported to have dealt with seed testing and seed quality control. They are usually managed from FAO through the help of a donor country that supports the course and the hiring of one to three consultants within or outside the region. The activities of the Seed Unit were discussed in Chapter III.

Current Interest and Needs of the Seed Sector

Technical and financial. As the seed sector evolves from the formative to a more advanced stage of development, the needs for technical and financial assistance change. For this reason the range of

interest and needs among countries today varies greatly. The forward movement of the seed sector is resulting in increased levels of interest in both technical and financial assistance in many countries. The growing technical needs place a demand on institutions to solve problems through research that relates especially to the requirements of the Latin American and Caribbean region. Communicating known and new information must be linked to this effort and requires a specialized communication network to reach the select and critical audience of the seed sector.

As seed enterprises develop and expand, the financial needs also change. Various kinds of financial incentives are needed to meet this growing requirement as seed programs and industries evolve. Providing credit at preferred rates, assisting with tax incentives and the leasing of facilities and equipment by the public sector to the private sector can contribute to meeting financial needs.

Goals, strategies and policies. Inadequate and unclear goals, strategies and policies inhibit seed sector development in several countries. Countries with limited development of the seed sector are especially affected by this problem even though they have adding several trained people to their programs from 1980 to 1986. At this time, more emphasis needs to be given to assisting countries in defining their seed policies and strategies.

Public crop research - seed sector cooperation. One of the most frequently observed deficiencies in national agricultural programs is the disjunction between various public and private entities. The National Agricultural Research Services (NARS) frequently fail to recognize that other public sector entities and the private sector can contribute to crop research as they all work to achieve increased food production. A strategy that has been used is the development of "National Commodity Programs" (NCP) that encompass the various public and private sector interests. Activities related to a NCP are described

in Chapter IV. The Commodity Programs of the IARCs could play a catalytic role in strengthening the linkages among these various activities. The CIAT Seed Program could be an essential part of this process because of its links with the private sector and seed associations.

Artesanal seed production and marketing. Resource poor farmers frequently do not have access to commercial seed. Most of the seed they use is saved from their own production or obtained from neighbors. Often the quality of this seed could be improved by the use of better and simple seed production technology which can help assure success of his crop. In addition, the traditional, commercial seed industry is not reaching many small farmers with improved varieties of crops such as beans, cassava, maize and potatoes. New, innovative mechanisms are needed to achieve more local seed production in the area of use. This is a first step in introducing the concept of quality seed and open channels for the spread of improved varieties. Countries need to seriously examine this issue and develop strategies to help small farmers obtain improved varieties and better quality seed.

Seed marketing is closely linked to artesanal seed production. Small farmers can produce seed more easily than they can sell it. Similarly, larger seed enterprises can produce seed suitable for small farmers, but developing economical marketing systems is a much greater challenge. Yet, examples exist of marketing hybrid maize seed and improved wheat varieties to thousands of small farmers in other parts of the world. The use of unconventional marketing outlets for seed, of small farmers as seed sellers and of mobile units that visit local market days are all possibilities that need exploring. The successful examples need documenting, so they can be duplicated in other locations. The Seed Program is in an excellent position to do this work and co-sponsor with seed associations special meetings on "innovative seed marketing to small farmers." The economic aspects of these activities need study and the Seed Program could lead work of this nature.

Seed production and technology research needs. Seed production and technology research oriented to the problems of tropical and sub-tropical areas is a neglected field. Past research in developed areas on quality maintenance is not always directly applicable to the more humid, higher temperature areas of the world. Much work is needed on the prevention of seed deterioration from field and storage fungi; efficient methodologies and/or systems for drying and storing seeds under adverse conditions; reducing seed-borne diseases especially in seed saved by the farmer for his or her own use; improved seed production methodologies; development of more rapid, reliable and portable seed quality evaluation methods; and establishing criteria for determining the need for fungicidal seed treatments. Newer research areas of improving seed quality through breeding opens opportunities that are potentially extremely valuable for the tropical areas. Various quality enhancement possibilities exist to improve seedling emergence under adverse conditions, but research is required. The use of seed as a carrier of systemic insecticides and fungicides, micro nutrients, herbicides and safeners has only been touched upon but much potential exists. Many of these techniques could be extremely valuable for small farmers.

Research in seed production and technology can be extremely valuable to the improved use of seed of crops in the CGIAR system. The CIAT Seed Program in cooperation with the Commodity Programs needs to place a higher priority on this aspect.

VI. THE IARCS AND OTHER SUPPORT TO SEED SECTOR IMPROVEMENT

The IARCS Current Position

As the IARCS began to develop and work with national programs, it was first thought that the development of seed sectors within countries would happen automatically as new varieties became available, especially since various bilateral and multilateral agencies were involved in supporting this aspect. However, the IARCS found, and still find, that many countries have weak seed sectors and, as a result, several IARCS have put effort into seed research and seed sector improvement activities.

In a survey of the IARC system, the eight crop-mandated IARCS indicated that they have activities specifically related to the development of seed programs and seed industries. It should be pointed out that the IARC seed development activities have evolved gradually, based upon needs identified, to help move the results of their seed-based technology through the national systems to the farmers. All eight have breeding programs and supply breeder seed to national programs for seed increase purposes. Several Centers also supply, or assist in supplying, the next stage of multiplication, basic seed (foundation seed), to national program cooperators or national basic seed units. Five Centers include training activities related to seed production and supply; one Center has developed an ongoing training program in seed production and technology geared especially to the needs of one region.

All eight IARCS have some staff time devoted to seed activities: one Center has three senior scientists working full time; two have one senior scientist working full time; two have senior scientists working part time; and all except ILRAD have some support staff involved in seed activities. Four Centers anticipate some increase in support for seed activities and five expect the level of support to remain constant.

Special initiatives by four IARCs have been taken to move toward a Seed Unit type of activity. ICARDA states that it, "feels that a stronger effort is needed to strengthen the seed industries in its region." It has a full-time seed specialist, is preparing to develop seed testing and seed conditioning facilities and intends to increase its seed production and training activities with a special focus on the North Africa and West Asia. "The present activities are carried out as a special project, but ICARDA will consider the seed production activities to become a part of its core activities." In Africa, ILCA developed proposal in 1984 to initiate a Pasture Seed Unit led by two Senior Scientists. ILCA has been delayed in implementing this proposal, but continues to plan for strengthening their seed effort through this project. IITA with the assistance of Mississippi State University, developed a proposal for a Seed Unit at that Center in 1985. The plan called for a Senior Staff of four specialists and an expenditure of over US\$8,5 million over five years. This project would concentrate on the crops on which research is done at IITA. Currently CIMMYT has a proposal for a Maize Seed Production Training Project for Sub-Saharan Africa centered in Zimbabwe. The potential exists for adding other crops to this US\$4,564,000 five year proposal. In support of this project the CIMMYT document states, "What is lacking then, is not the basic germplasm resources but the infrastructure for delivering it."

A fifth initiative taken in Africa by Winrock International at the request of the International Center Directors concerned with Africa has been a study to determine the needs for a Seed Unit or units for Africa as a whole. This study was completed in 1985 with the assistance of three donors. A consensus has not been reached on the course of action to follow after this study. All of these efforts show a growing concern about seed supplied on the part of several IARCs.

Importance of the Seed Sector to the IARCs

Today, although improved varieties are being developed, the lack of available good quality seed has become a major constraint to adoption. To overcome such a constraint and to realize fully the benefits to be obtained from crop research, seed production and supply systems must be

improved. The seed sector, involving basic seed programs, the commercial seed industries, seed associations, and governmental bodies and institutions concerned with seed, become a significant and dynamic factor in the spread of improved varieties. Policy makers and key crop research and extension personnel must recognize that the seed sector plays an important, highly effective, and continuing role in the agricultural development of a nation or region, particularly in the introduction, spread, and maintenance of seed supplies of improved varieties.

The seed sector is important not only for the adoption of improved varieties but also for their rate of adoption. If the time for adoption is shortened, then the farmer benefits earlier and the internal rate of return on the investment in research is increased. A strong seed sector, by continuously and rapidly making available good quality disease-free seed, hastens the rate of adoption and helps maintain the achievements. However, the strength of the seed sector comes from maintaining close ties with national crop research programs. The IARCs need a dynamic seed sector in each country if they are to make a maximum impact in agricultural development.

CGIAR Position on Seed Sector Improvement

Although many of the IARCs have slowly assumed some responsibility to help improve aspects of the seed sector, these actions have been taken on a center by center basis. The Technical Advisory Committee (TAC) for the CGIAR system has been aware of these developments, but has never dealt with the question formally. In a TAC Report, Study of Training, done on the IARCs, one finds the following statement:

1. "CIAT's training in seeds has helped to develop the seed industry in many nations of Latin America and the Caribbean,..."

2. "There is also a large demand for training related to seed, which could, we feel, be broadened even further, particularly in respect of economic, legal and management considerations, and in research".

The TAC Study on priorities lists one specific objective that refers to seed as follows: "Strengthening national research capabilities --including the development of institutional capacities in research areas such as seed multiplication and distribution facilities." These isolated statements show a concern for and desire to do "something" about seed production and supply. However, the CGIAR system lacks a definitive statement regarding its position in assisting the improvement of the seed system at the national level.

The IARC Directors have worked during the past year and one-half to develop a Position Paper on the "IARCs' Role in Seed Research and Seed Sector Improvement." This paper is under review and is to be discussed by the Center Directors at their meeting in June 1987. It appears that the Directors are coming close to a common position that would support the basic concept that the IARCs should do more in seed research and seed sector improvement. They also appear to be supporting the need for individual Commodity Programs to place more effort on assisting the development of effective seed systems while working together on a regional basis through some kind of Seed Unit type of activity.

Activities of Technical Assistance Agencies and Donors

As stated earlier, one reason for the lack of a consistent and unified approach by the IARCs was the feeling by many leaders in the system that other agencies were working to improve the seed sector and that the IARCs had little to offer.

However, experience shows that most donor and technically assisted projects are of a short-term nature (two to four years) or are subprojects within larger projects. These projects and those of other agencies have helped build seed conditioning facilities, equip seed

testing laboratories, start commercial seed enterprises, train people, and consequently have helped to spread the adoption of improved varieties. However, because of their short-term nature, such projects frequently achieve only limited objectives toward the improvement of a total seed program. Too often projects started with outside assistance falter when that help terminates, either because the activities were not firmly established at the time or because national funding was not available to continue it.

The complementary nature of the CGIAR effort can best be illustrated by listing needs observed in national seed projects: seed for multiplication and the technological know-how is often lacking; institutions to provide the necessary training in the appropriate language are scarce or nonexistent; seed specialists have difficulty finding relevant backup material; in-country seed courses usually need technical assistance from outside the country; short-term projects normally do not have the means to research those seed technology and production problems that seriously limit the success of the project; projects often start afresh with no accumulation of previously developed training material or memory of past failures or successes; and projects frequently focus only on one aspect of the seed sector with limited links to all the essential elements needed in a integrated seed program.

The proposed increased effort by the IARCs will become a small but critically valuable complementary effort to those national projects in seed development that are at present undertaken, and will continue to be undertaken, by donors and technical assistance agencies.

Because the CGIAR system is not in a position to support financially or to manage such projects, donors and technical assistance agencies should not only continue but also expand their efforts to assist directly in the improvement of the seed sector at the national level. Nevertheless, the seed units, supported by commodity specialists, can provide needed assistance in the identification, preparation, and evaluation of seed projects so to help direct resources to the most appropriate seed program activities.

The IARCs, could assist the seed sector in developing long-term, fully operative, and effective seed programs and industries within countries. The IARCs could link seed activities to the goals of the national- international crop research network, provide continuity and consistency of effort, and strengthen seed systems so that improved varieties reach farmers quickly.

The long-term objective must be to fully utilize the strengths of all concerned in seed sector improvement--to help national governments and seed industries improve the systems and infrastructure required to move large quantities of good seed of improved varieties to more farmers.

Because of their international and long-term nature the IARCs have a number of advantages over other research and technical agencies in terms of personnel, continuous and consistent efforts, provision of training, documentation, and information services, and even in geographic location.

CHAPTER VII. OPTIONS FOR THE FUTURE

The Study Team was impressed by the consistent expression of interest and concern for the future of the Seed Unit. This interest came from many individuals interviewed in both the public and private sectors, including research agencies, universities, and seed companies.

Organized seed sector activities are of relatively recent origin. They face innumerable problems of an organizational, technical and policy nature and have limited places to turn to for assistance. Many such organizations (both public and private) have come to look at the CIAT Seed Unit as the authority to which they can turn to for help. Data available in the countries visited show in general a rather low level of adoption of improved varieties except for some crops in some regions. The reason given in most instances was that seed materials of adapted improved varieties are not available to the farmer. Other reasons are also cited but most people are convinced that adoption rates would be higher if improved seeds were available. Constraints to improved seed adoption frequently mentioned were:

1. inability of public agencies to deal with variable ecosystems and the disinterest generally of the private sector in addressing this issue;
2. preferred use by producers of their own seed;
3. lack of appreciation of seed quality in agronomic systems;
4. lack of trained persons in public service systems who understand the importance of seed quality;
5. the general dichotomy of public crop improvement programs which in part are oriented to the resource poor sector where adoption rates remain low, while major resources are applied to programs for producers in more favored areas.

6. poor relationships between public and private sectors affecting ease of access to basic seed, commercialization, certification and marketing.

Analyzing further the status of the seed sector in various countries of the region (see Chapter V), it is apparent that we are dealing with systems which are still inadequate to assure that the technology which is a germplasm based technology developed by the IARC's and the National Agricultural Research Services (NARS's) will have a short adoption span.

General Considerations

The Study Team has not included among the options the alternative to terminate the Unit in the near term. Data relative to factors such as yield levels and adoption rates, and the inadequacy of the present systems to assure the availability of quality seed, support continuation of an activity of this nature. The rhythm of progress achieved thus far, the recognition of the importance of the seed sector and the attempts by public and private agencies to upgrade their seed activities argue for a continuation of the kind of leadership provided by the Seed Unit at CIAT.

Furthermore, the Study Team senses that the problem of deficient seed systems is pervasive in many developing countries and is a major constraint to the dissemination of improved genetic materials emanating from the IARC's. Although this limitation may not apply equally to all crops in all regions, it is of sufficient importance to have caused other IARC's to initiate or contemplate seed programs. It would be illogical to initiate new programs in one part of the system while terminating similar activities in another part of the system. Rather it would seem prudent to examine the experience of the Seed Unit at CIAT and determine the extent to which that experience can be utilized in the wider context of the CGIAR system. How the CGIAR system decides to deal with seed issues, is addressed only partially in Chapter VI. It is the view of the Study Team that this question deserves the attention of the

CGIAR. The strengthening of national seed systems is an extension of the process of strengthening national agricultural research systems, especially those in which most of the agricultural research is conducted in public sector institutions. Seed multiplication by whatever system is the means by which the results of research reach the producer.

Table 7.1 summarizes the principal options that might be considered for the future development of the Seed Unit. Variations or modifications to these options might also be considered but the possible number of permutations is so large that only the major structural programmatic forms are considered. On the issue of funding, the Study Team recognizes that amounts and sources of funding might influence the form and direction of the seed activities options. This aspect, however, was not a determinant in defining the options shown. However in discussions held during the course of this study, we were able to identify certain characteristics which a seed programs should possess. Among those qualities were the following:

1. the institutional umbrella should be international in scope, stable and of unquestioned scientific and technical competence and credibility;
2. there should be strong linkages of seed programs to Commodity Research Programs;
3. the seed programs should have an Advisory Board on which experts from user nations and seed producers are represented;
4. it should have a capability in each component area of seed technology, including policy development;
5. seed program leadership and staff must be of high quality and able to interact with both public and private sector agencies in each nation;

6. it must have adequate physical facilities to conduct the training, research and service function associated with seed technology including land, laboratories, seed processing machinery, etc.

Options for the Seed Unit

Option I. Transfer the Seed Unit to a Regional Organization in Latin America or the Caribbean. This could not be a one sided decision. It is not known if any existing institution would or could assume the responsibility of operating a seed program. Some training in seed technology is conducted by the United Nations Food and Agricultural Organization (FAO) and the Inter-American Institute for Cooperation on Agriculture (IICA) has been involved in some seed related activity. Most of the potential candidates pose serious limitations especially resources, staff, and infrastructure. These limitations could conceivably be overcome in time.

Perhaps a more realistic model would be to identify areas of mutual collaboration in which the regional institutions would play a greater role than they are now able to achieve. In this way, the regional institutions could strengthen their support of national seed programs and also enable CIAT to concentrate on areas in which they have a comparative advantage. A full transition of the CIAT seed program activities to a regional institution could be feasible in time.

Option II. Establish the Seed Unit as an Autonomous Activity Closely Associated with a Regional Body, or with CIAT or other IARC.

Complete autonomy within the structure of CIAT is at least one step removed from the present arrangement. Experience to date at CIAT has shown that greater effectiveness of the Seed Unit is achieved by close association and integration of seed program activities with those of other CIAT programs. CIAT has moved more and more in that direction. In its discussions with individuals in national programs, it became clear that a point of major weakness in national seed systems is the disjuncture between crop improvement activities and seed technology and

management related activities. Physical or institutional separation aggravates that problem, the result of which is jurisdictional conflicts, weakness in any number of seed related functions, and inability to provide appropriate quantity and quality seed for multiplication and use by farmers. A great advantage of having in one institution the array of functions related ultimately to seed production (i.e. germplasm banks, plant breeding evaluation, basic seed multiplication, multiplication, seed technology research, etc.) is that these are real activities that can be closely observed (and in some participated in) by trainees in seed technology. The trainees in seeds should become acquainted with the crop and its management.

Another important aspect of this close association is that it enables seed technologists to understand the role of the plant improvement experts and vice versa. For example, a particular variety may be excellent as a grain crop but terrible as seed. If the variety is not acceptable as seed, it will not be multiplied.

The Study Team was particularly concerned with the matter of linkages in the continuum of seed related activities (see Chapter IV) both within the CIAT organization and in the national seed sectors. One reason for deficiencies in the national seed operations is the separation that exists among the different seed functions. As a training and demonstration function at CIAT, these same linkages should be clear and visible. At least one concern about autonomy of the Seed Unit could be that of further isolation of Seed Unit function from the commodity research programs.

If the Seed Unit were to have full autonomy, it would be preferable to keep it associated with CIAT rather than completely (physically) move it to another location, as this would cause the least disruption in the Seed Unit activities. Also the association with CIAT would respond to the strong desires of seed sector leaders to keep the operations under the CIAT mantle. This does not mean, however, that the autonomous concept could not be achieved under some other arrangement.

Two other aspects of "autonomy" must also be considered. First is the question of funding. (The issue of funding is treated elsewhere in this document). Suffice to say that the further removed the Seed Unit is from full acceptance within core program activities of CIAT or other institutions, the greater is the responsibility for finding its own support. The second aspect of "autonomy" is a managerial one. While autonomy implies independence (perhaps with an independent Board), potential conflicts from operating within the domain of the associated institution are inevitable. Questions of ultimate authority would need to be defined as carefully as possible. Again, the Study Team feels that if this option were elected, this issue could be satisfactorily agreed upon. Furthermore, it is felt that autonomy could be achieved but with considerable reliance on the CIAT infrastructure for administrative support, use of facilities, machinery and so on.

Option III. Incorporation of the Seed Unit as an Integral Part of the CIAT Program. Perhaps the least disruptive approach, and one offering not only continuity by gradual evolution and expansion of activities would be to fully incorporate the Seed Unit as a Core Program of CIAT. The major constraints to this having occurred in the past seem to be conceptual and financial. Reference has already been made to the conceptual issue as indicated by the EMR in the 1984 review. The Study Team feels that seed technology activities have approval "de facto" as legitimate IARC activities particularly as an extension of Commodity Program needs. While the CIAT Seed Unit is more than an extension of Commodity Program needs, it has not achieved full program status. If either Option III or Option IV are elected, it would become desirable (perhaps necessary) to satisfy whatever procedural steps are involved to enable CIAT or other IARC to develop seed technology in the fashion they consider appropriate.

For the present, the Special Project approach is inadequate since the task of building seed capability is a longer process than most agencies are willing to fund under Special Projects. The issue of full

integration with core activities seems to relate mostly to funding arrangements, and a key element of that issue is the competition for funds among programs. Restricted core funding (under current CGIAR definitions) might be acceptable provided adequate funding could be generated (perhaps by additional contributions of several donors). We believe the mechanism of restricted core funding would be appropriate to assure the funding of seed activities, and avoid the issue of competitiveness of the seed program with other program budgetary needs. These advantages from the CIAT perspective, do not resolve the issues related to the categories of donor contributions to CGIAR activities.

Option III would seem to be a viable alternative most likely to maintain the status quo (organizationally) but offering some scope for seeking additional sources of funding and strengthening seed program activities.

Option IV. Establish the CIAT Seed Unit as a CGIAR-wide System under a Board or Advisory Group. The general inadequacy of seed systems in many developing countries is widely recognized. It is a major impediment to adoption of improved seed materials and an important reason for the initiatives of other IARC's in this activity and for investments and loans by development agencies (See Chapter VI). Whether or not the CGIAR donors wish to focus more specific efforts as a group on strengthening seed programs is not known. Obviously, individually, many of them are already involved and support activities related to the seed sector.

The CIAT Seed Unit offers a model for effectively addressing seed development problems. Many of the processes and procedures for seed management are generic and apply equally to many crops and many regions. Institutional and policy differences among nations have to be recognized but are no more complex than when dealing with other agricultural development problems. The experience of the Seed Unit should be invaluable to efforts in other regions.

How such a CGIAR-wide system should be organized would require additional study. The Seed Unit and CIAT has taken the initiative to circulate a Position Paper which develops the concept of an IARC Network System. The advantages of association of Seed Units such as that of CIAT to IARC's has been reviewed in Chapter VII. Whatever the form of the association of the seed technology activity with the respective IARC, a network or linkage should be established to facilitate exchange of experience. One part of such a network is in place at CIAT. Proposals for a Seed Unit in Africa have been made.

A CGIAR wide strategy could rationalize donor support for seed improvement programs in which one or more IARC's participate. A mini consortium of donors might thus emerge to jointly finance the small network of Seed Units designed along the CIAT model, but whose specific activities were designed to address the needs of the countries in their respective regions. Donor support could thus be more focused, assure linkage of national projects with the IARC network and benefit from accumulative experience within the system.

Table 7.1. CIAT - Seed Unit Options for the Future

<u>Option</u>	<u>Arguments for</u>	<u>Arguments Against</u>
I. Negotiate a Transfer of the Unit to a Regional Organization in Latin America and the Caribbean	<ol style="list-style-type: none"> 1. Seed technology is in part a development function which should be assumed by development and assistance agencies. 2. In Latin America at least one agency has a presence in all countries. A structure is in place. 3. As a regional unit, responses to countries would be more directly related to country initiatives. 	<ol style="list-style-type: none"> 1. Articulation with research programs of IARC's not assured. 2. Existing capability and experience inadequate. 3. Funding would be a problem unless special funds became available. 4. The Study Team found little support for the option among country leaders.
II. Establish the Seed Unit as as Autonomous Activity for Latin America but Closely Associated with a Regional Body or with CIAT or other IARC	<ol style="list-style-type: none"> 1. Operational autonomy implies greater freedom and flexibility of action. 2. Given resources, the Seed Unit would be able to expand its programs especially research, regional presence and consulting. 3. Unit might attract other sources of support and engage in project identification and execution contracts. 4. Association with CIAT would retain a linkage with a prestigious institution. This association is considered highly important by practically everyone interviewed by the Study Team. 	<ol style="list-style-type: none"> 1. If the Seed Unit were moved, provision for land and physical facilities would be required. Some interruption of programs could occur. 2. Costs of operating an autonomous unit would likely be greater than that of a Sub-Unit of an existing organization. 3. Association of the Seed Unit with a non-CGIAR Center would distance the Seed Unit activity from IARC commodity interests. 4. There would be a need to negotiate a new legal agreement with the host country.

Table 7.1. Continued

III. Incorporate the Seed Unit as an Integral Part of the CIAT Program

1. This option would be the least disruptive to the program and would allow for modest augmentation of key activities in research, regional and national training and consultancy.
2. The program linkages with commodity research programs would be strengthened.
3. It would allow the program to build on an established record of accomplishment and the very considerable good will extant in the region.

1. Incorporation of the Seed Unit would need to be accompanied by appropriate budget increases accepted by the CG and donors. Incorporation without budget increases would cause considerable internal conflicts and probably result in an ineffective unit.
2. As an integral part of CIAT operations, the Seed Unit may lose some qualities associated with its semi-autonomous character.
3. It is uncertain at this time at least, if the Seed Unit would be viewed with equal importance of Commodity Programs.

IV. Establish the CIAT Seed Unit as a Component of a CGIAR-wide System under a Board or Advisory Group

1. Establishing a seed network within the CGIAR System would facilitate response of IARC's to pressures for assistance in this activity.
2. A single system would avoid unnecessary duplication at each Center provided additional Units were strategically located to respond to IARC program and country needs.
3. Experience with seed development programs could more easily be shared in a network framework.

1. IARC's feel such arrangements may not respond to their specific commodity needs.
2. Networking among strategically located Seed Units may be difficult unless careful agreements are worked out among Centers.
3. Conflicts may arise between the Seed Network Advisory Board and the respective IARC as to priorities, budgets.

CHAPTER VIII. RATIONALE FOR FUTURE DEVELOPMENT OF THE SEED UNIT

Needs of Seed Programs of The Region

The original project document that resulted in the establishment of the Seed Unit stressed the need to accelerate the development of the seed programs in the region because progress during the past 20 years had been slow. The lack of seed programs and clear policies were reported weak in many countries. The great void in the number of adequately trained personnel was especially emphasized. Inadequate or absent marketing and seed supply delivery systems were pointed out as bottlenecks to progress.

In examining the seed sector now, ten years later, it must be admitted that some of these same needs still exist and that eight years of operation of the Seed Unit have not solved all problems. Yet, today as the team talked with national seed program leaders and people in the commercial seed sector a clear sense of "we have not solved all the problems but we are one the way toward solutions and the system is moving" clearly prevailed. Needs do exist, but giant strides have been made in many countries. The status reports completed by the Seed Unit in 1986 give a good assessment of needs country by country. This kind of information did not exist in 1977. The information developed by the CIAT Seed Task Force on individual commodities adds further to a more complete understanding of current needs and what is required to meet these needs.

Availability of seed. The ability of the seed sector to supply seed of improved varieties of crops such as beans, maize, cassava, potatoes and other self-pollinated crops especially to small, limited resource farmers remains extremely limited. Some countries still have not developed clear goals, strategies and policies to assure the sound, long-term development of the seed sector although progress is clearly being made in the region. Greater stress is needed on helping those countries that have not made progress in this aspect.

Shortage of trained specialists. The strong training effort of the Seed Unit has clearly contributed much to human resource development. Former course participants are definitely lifting the level of the seed sector operations in many countries. Yet, an expanding seed sector has immense needs for trained people at many levels. Obviously, the Seed Unit cannot meet this total need. More must be done within countries to more adequately utilize the people trained at CIAT in increased training at the national and state level. Countries generally seem to lack clear seed training and personnel development plans --these are needed. The private seed industry has benefited from Seed Unit training, but the team sensed that this huge need was not being met adequately either by CIAT or within countries. Much future training and research in seed technology and production must be done by universities that can offer both support to degree training and short courses. For these institutions to meet this need continued upgrading and training of their staff and facilities is required. In these cases, additional people trained at the M.Sc. and Ph.D. level are required, yet little support for this level of training exists. Leaders of seed activities at the national level need increased opportunities for degree training at the M.Sc. level and these opportunities, too, are quite limited. The Seed Unit needs to be able to support additional thesis work to help meet these needs. The people visited expressed a great need for the Seed Unit to continue to offer especially advanced, specialized seed courses in Spanish. This possibility for the continued upgrading of the existing staff was considered to be extremely important for the future development of their programs.

Additional research. Initially, it was felt that existing knowledge in seed production and technology would meet the needs of the region and this has been true in many ways with several crops. However, the growth and development of the seed programs and industries and special needs of the many tropical pastures species now on the horizon clearly show a need for a much stronger effort in seed research. The Workshop on Seed Research and Training sponsored by the Seed Unit in 1985 points to many needs that exist. Although the Seed Unit cannot and

should not try to meet all of these needs, a greater portion of the staff time needs to be devoted to research. Increased links with the Commodity Programs will be especially helpful in meeting these needs.

Communication and information. The Seed Unit represents the only effective system in the region for providing a communication and information network on seed technology. The evolving seed associations and their attempts to develop a regional network is an impressive development but these activities are fragile and require nurturing before they can play an effective role in communication and information. The spread of seed technology and production information from the developed to the developing countries in the region and from the CGIAR Commodity Programs to the seed sector should be expanded.

Linkages to technical assistance agencies. Although the Seed Unit has made strides in helping to link with technical assistance and donor agencies in the region, it is clear that much remains to be done in developing an effective network among these groups. The Seed Unit has information about national seed programs and people within those programs who can be useful in developing or assisting seed projects. A need exists to find ways for this resource to be more fully utilized by other agencies.

Justification

Without exception people in both the public and private sector met at the national level were strongly supportive of the Seed Unit at CIAT. Even the suggestion of placing this activity with another organization brought quick reasons why they felt CIAT was the best place for the Unit. The combination of the image of CIAT as an International Center with a strong orientation toward Latin America and the Caribbean and the professionalism that exists in the Seed Unit today were the primary reasons given. They did not want to give up what had been achieved during the past eight years and any modification of the basic pattern they feared would result in losses rather than gains. The team fully supports these views.

The continued release of improved varieties by research programs and the lack of rapid spread of these varieties is justification in itself to continue to work with the seed sector. The international-national research network has been greatly strengthened during the past 15 years, but unless improved varieties are used on farmers' fields the expenditure in research is an academic exercise. On a regional basis, the Seed Unit is the best mechanism available to assist the countries as they work to get improved varieties used. It is also in a unique position of being able to relate easily to the Commodity Programs of the CGIAR and help them develop the bridge needed at the national level between research programs and the seed sector.

Some countries and commodities need the assistance of the Seed Unit more than others. The countries with the greatest need tend to be smaller and those with the lowest income levels. The maize and sorghum hybrid seed programs are stronger than those of the self-pollinated crops. Even within the latter group differences exist and the movement of improved varieties to smaller farmers, especially, is going to require a sustained effort in developing effective mechanisms over a period of time. With crops such as sorghum, cotton, and vegetables the region relies heavily on imported seed today. Many countries do not have the indigenous capacity to maintain research and seed production capabilities of these crops. Even though, the Seed Unit may not put a high priority on the non-CGLAR crops, it would be able to help countries identify sources of assistance from outside or inside the region. The Unit's work with other crops would have a complementary value for the total seed sector even though some crops are not given a high priority. The team feels these differing needs must continue to be recognized and represent a further justification for a Seed Unit.

An evolution is occurring in biotechnology which can have a significant impact on the seed sector. The Seed Unit's future links with the biotechnology work at CIAT and other Centers will provide a way for the commercial seed industry to keep abreast with developments and utilize these advances as early as possible. Related advances can be

expected in seed technology. Some of the enterprises and programs in the region are in a position to move rapidly as these advances are made, but they will need the technical backup of a Seed Unit. The development of a more effective information and communication program through the Seed Unit and perhaps in cooperation with associations will provide the means to keep the total seed sector informed on international and regional developments.

Organization and Structure

Objectives to be achieved. The organization and structure for the future of the Seed Program should be designed to help achieve the following:

1. The means to provide increased targeted assistance to national programs.
2. Sufficient flexibility to act and respond to a range of public and private sector needs.
3. The capability to develop close links with all CGIAR activities in the region.
4. The ability to work with and provide services to donor and technical assistance agencies operating in the region.
5. Operational and funding stability so plans can be developed for the next 10 years without major concern about these points.
6. Sufficient financial support and independence for seed activities to avoid becoming competitive with the regular CGIAR Commodity Programs.
7. Increased financial support to provide the means to more rapidly achieve program objectives.

Mechanisms for achieving the objectives. Changing the Seed Unit to a Seed Program places the seed activity at a level in the CGIAR system that it can be recognized as a function with sufficient priority that several of the objectives outlined above can be achieved more completely and easily. Making this change opens possibilities for operational flexibility not now possible with a Unit. For example, the outpostting of staff is a normal activity of CGIAR programs, but it is not normally done with units. It is clear that the goals to be achieved through the Seed Program go beyond the purpose of just providing support to the Commodity Programs although support is a part of these activities.

To help the Seed Program achieve needed flexibility and stability in its operation while remaining within the CGIAR system, it is proposed that a Seed Program Advisory Committee (SPAC) be established by CIAT management and approved by the Board. The SPAC, which would include representation from the Board, CIAT management, another IARC, and members from the public and private sector in the region, would provide the means to help achieve the linkages needed and continuity of program to meet the long-term objectives of the Seed Program. The details and responsibilities for the SPAC are given in Annex 6.

To provide the extra support for assisting national programs in the development of plans and to provide more assistance to donor agencies in the preparation of projects, it is recommended that a third senior staff position be added to the present staff of two senior staff members. The requirements for this position should carry a strong agricultural economic component with a seed technology and production development orientation. The person in this position would also be able to support the accumulation and management of information about the status of each country's seed program, the spread and use of improved varieties, and the varieties released into programs. He or she would also be in a position to lead a range of needed economic studies and cooperate with other economists in the programs and IFPRI. Ideally the training and communication officer should also be a senior staff person.

The major role of training, communications and documentation in the Seed Program require the attention of an experienced professional.

This three man team at headquarters would be assisted by an outposted staff member in the Central American region and one working in the Andean zone with a special emphasis on Ecuador, Peru, Bolivia, and Paraguay. The CIAT report projected these positions as special projects and the team concurs that these positions need not be core and could be established as special projects with at least a five year plan of work.

To further strengthen the linkages between the Seed Program and the Commodity Programs, the process that has started to identify a person in the Commodity Programs with special responsibility for seed activities is encouraged. The Tropical Pastures Program has long had a senior staff position with supporting staff on seed production and research. The other Commodity Programs do not need that much support, but for them to either assure that some senior staff time be devoted to seed activities or identify an experienced junior staff member to concentrate on seed production and research would be quite useful. With this arrangement the Seed Program could then develop mechanisms for integrating these activities and the joint activities that would develop with the ongoing activities of the Seed Program. These "commodity seed specialists" would be especially helpful in contributing to country specific work on a commodity and in training activities that relate to production agronomy and seed of a particular commodity. Good cooperation has existed between the Seed Unit and the senior seed production staff member of the of the Tropical Pasture Program. However, consideration is needed on how his work, especially as it relates to the basic seed and commercial seed industry development, links with the Seed Program. Conceivably some kind of joint appointment between the two programs might be considered to further help the integration process. Some of his work clearly relates to the needs of the Tropical Pasture Program and justifies a continuing close association with that Program.

Currently, the Seed Unit has a Visiting Research Fellow on a two year assignment from CETREISEM, Brazil. It has has other people in the past from universities in the region on similar appointments. A continuing series of these appointments are recommended for the future because they have definite value for the person involved and provide a way for the Seed Program to continue to develop close links with other training and research programs in the region.

The appointments of Visiting Scientists and Consultants from outside the region have given the Seed Unit the means to draw upon the best seed specialists available internationally to help achieve specific objectives. These kinds of appointments have been extremely valuable and should be continued as a way to further strengthen the program.

The Seed Unit's junior staff have carried considerable responsibility in helping the Unit achieve its objectives in the past. The continued training and upgrading of the junior staff will be an additional way to further strengthen the professionalism of the staff and move ahead on some needed research work. Providing for an experienced junior staff member with full-time responsibility for the seed testing laboratory and tropical pasture seed production will be another way to further strengthen these aspects of the program. The Seed Program will need a minimum of three full-time secretaries instead of the present arrangement of two full-time plus considerable part-time help.

Services have been provided to the Commodity Programs and the Colombia seed program primarily through the drying and seed conditioning facilities. This kind of service appears extremely valuable and should be continued. However, as the Colombian institutions further improve their facilities, it is expected that less demand will come from these organizations. The Commodity Programs should continue to assess their drying and handling of material in the light of the facilities in the Seed Unit. The continued development of drying capacity in the Seed Unit

ANNEX 4

AUDIOTUTORIALS ON SEED TOPICS AT CIAT

- Control y Normas de Calidad de las Semillas Certificadas de Arroz
- Desarrollo y Morfología de la Semilla
- Elementos Esenciales para el Exito de un Programa de Semillas
- Essential Elements for Successful Seed Programs
- Evaluación de la Calidad de la Semilla de Maíz
- Good Quality Bean Seed Production
- Latencia y Pregerminación de la Semilla de Arroz
- Maize Seed Quality Evaluation
- Morfología de la Planta de Arroz
- Morfología de la Planta de Frijol Común
- Morfología de la Planta de Yuca
- Principios del Acondicionamiento de Semillas
- Producción y Beneficio de Semilla Certificada de Arroz
- Seed Development and Morphology
- Selección y Preparación de Estacas de Yuca para Siembra
- Semilla de Frijol de Buena Calidad
- Sistema de Propagación Rápida de la Yuca
- Técnicas de Muestreo

ANNEX 5

SEED ASSOCIATIONS IN LATIN AMERICA AND THE CARIBBEAN

	<u>Country</u>
ASOCIACION SEMILLEROS ARGENTINOS (ASA)	Argentina
ASOCIACION ARGENTINA DE TECNOLOGOS EN SEMILLAS (ASARTES)*	Argentina
CAMARA DE SEMILLERISTAS DE LA BOLSA DE CEREALES (CSBC)	Argentina
CORPORACION ARGENTINA DE PRODUCTORES DE SEMILLAS (CAPS)	Argentina
ASOCIACION NACIONAL DE PRODUCTORES DE OLEAGINOSAS (ANAPO)	Bolivia
ASSOCIACAO BRASILEIRA DOS PRODUTORES DE SEMENTES (ABRASEM)	Brazil
ASSOCIACAO BRASILEIRA DE TECNOLOGIA DE SEMENTES (ABRATES)	Brazil
ASOCIACION COLOMBIANA DE PRODUCTORES DE SEMILLAS (ACOSEMILLAS)	Colombia
FEDERACION LATINOAMERICANA DE ESPECIALISTAS EN SEMILLAS (FELAS)*	Colombia
ASOCIACION DE PRODUCTORES DE SEMILLAS (APS)*	Costa Rica
CAMARA NACIONAL DE PROCESADORES DE SEMILLAS (CNPS)*	Costa Rica
ASOCIACION GREMIAL NACIONAL DE PRODUCTORES DE SEMILLAS (ANPROS)	Chile
ASOCIACION DOMINICANA DE ESPECIALISTAS EN SEMILLAS (ADOTES)*	Dom. Rep.
ASOCIACION DE PRODUCTORES DE SEMILLAS (APS)	Ecuador
ASOCIACION REGIONAL ANDINA DE SEMILLAS (ARAS)*	Ecuador
ASOCIACION REGIONAL DE TECNOLOGOS EN SEMILLAS (ARTES)*	El Salvador
ASOCIACION NACIONAL DE SEMILLERISTAS DEL SALVADOR*	El Salvador
ASOCIACION NACIONAL DE TECNOLOGOS DE SEMILLAS CERTIFICADAS (ANTES)*	Guatemala
ASOCIACION DE PRODUCTORES DE SEMILLAS DE GUATEMALA (APSG)*	Guatemala
ASOCIACION NACIONAL DE PRODUCTORES Y COMERCIANTES DE SEMILLAS DE HONDURAS (ANAPROCSEH)*	Honduras
ASOCIACION MEXICANA DE SEMILLEROS (AMSAC)	México
SOCIEDAD MEXICANA DE TECNOLOGOS DE SEMILLAS (SOMETES)*	México
ASOCIACION PANAMEÑA DE PRODUCTORES Y TECNICOS DE SEMILLAS (APROTESEM)*	Panamá
ASOCIACION DE PRODUCTORES DE SEMILLA CERTIFICADA (APROSEC)	Perú
ASOCIACION NACIONAL DE PRODUCTORES DE SEMILLAS CERTIFICADAS (ANAPROSE)	Uruguay
CAMARA DE SEMILLERISTAS DE URUGUAY (CAS)*	Uruguay
ASOCIACION VENEZOLANA DE TECNICOS EN SEMILLAS (AVECTES)*	Venezuela
CAMARA NACIONAL DE PRODUCTORES DE SEMILLAS (CANAPROSE)*	Venezuela

* These Associations have been formed since the Seed Unit was started.

ANNEX 6
SEED PROGRAM ADVISORY COMMITTEE

Activities related to seeds cover a wide spectrum of institutions, agencies, technical competencies and types of actions from policy formulation to trade. Also we have stressed the importance of integration of seed programs with those that give rise to seed materials and move them through marketing systems to farmers, commodity programs at CIAT. To help assure that the activities of the seed program meet the needs of the countries of the region and strengthen cooperation with appropriate regional institutions, the formation of an Advisory Committee is recommended.

Purpose. The Advisory Committee would provide advise and guidance to the seed program assisting it in coordinating and orienting program activities, facilitate interaction with other agencies and assist in identifying sources of support.

Composition. The Advisory Committee would be composed of seven persons, as follows:

- Seed Program Director - ex-officio
- Member Board CIAT (from Board Program Committee)
- Member CIAT Management
- Private Sector
- Other Public Sector Research or Seed Program Institution
- Education Institution
- Other IARC

Persons may be recommended for membership to CIAT management and would be approved by the CIAT Board.

Term. The initial Committee would be appointed as follows:

- 2 members for 3 years
- 2 members for 4 years
- 2 members for 5 years

Each person would then serve a three year period.

Meetings. The Committee should meet once yearly.

Responsibility. The Committee would report to the Board of CIAT through the Program Committee. The Committee would:

1. Provide a coordinating mechanism in seed improvement activities between the Seed Program at CIAT and national and international agencies in the region.
2. Review activities of the Seed Program and provide guidance on the nature and content of the program.
3. Consider financial support for the Seed Program and assist in assuring adequate support for the Program to achieve its objectives.
4. Provide CIAT management and the board with periodic reports on progress of the Seed Program with advice on improvement and changes in activities.
5. Assist in identifying critical areas of need and suggest methods of meeting needs.

find that it had not been possible to develop closer collaborative arrangements with these efforts although it was good to learn that several former Seed Unit course participants have been able to assist these courses. As indicated earlier, it would appear that the Seed Program could be of considerable assistance to various multilateral and bilateral agencies supported projects. The team recommends that mechanisms be explored to develop more formal links with these organizations for the benefit of the seed sector and farmers in the region.

Relationships with Other Groups

One of the strengths of the Seed Unit has been its ability to relate to a wide range of organizations within and outside the region. Obviously, its links with clients such as national seed programs, seed quality control agencies, basic seed activities, seed enterprises, seed associations, universities with seed training and research programs, and crop research programs are essential to its success. In looking at the long lists of people who have contributed to the Seed Unit's program of activities it is clear that links have been developed with many groups outside the region. The assistance of Mississippi State University has been extremely important in helping the Unit achieve many of its objectives. However, links with other universities including Oregon State University, Iowa State University, Ohio State University, and the University of Edinburgh have also be quite helpful. As the Seed Program moves ahead, it is vital that all of these ties be further strengthened. The Seed Program is quite different from most of the Commodity Programs that often start out with the major strength through their germplasm base and strong research programs. In the seed sector considerable strength exists outside the region that can be utilized by the Seed Program for the benefit its clients within the area.

The other group to which the Seed Program should relate more closely are donors and technical assistance agencies with activities in the region. The Seed Unit has involved these groups in workshops and had various kinds of communication with them. However, the team recommends that the Seed Program focus especially on increasing these links in the future. For example, IICA has proposed that consideration be given to cooperation in: 1) help countries to define seed sector related policies, 2) training at a regional level and support to national training efforts and 3) design of projects for investment in the area. CATIE has interest in seed research and development and can offer several possibilities for assisting the seed sector in Central America. FAO offers seed courses in countries periodically in the region and an occasional regional course. The team was surprised to

To enable CIAT to move more forcefully into this area, it is suggested that one of the key staff members of the program be a recognized expert in the area.

Seed and Commodity Program Relationships

One of the great values of having a seed activity located with an IARC is the technical and physical support that is available to it. The Seed Unit has obviously benefitted tremendously by being able to utilize the resources of CIAT and start operation with a minimum of delay. Of even more potential value is the mutually beneficial relationships that can develop between the Seed Program and the Commodity Programs of the CGIAR working in the same area. These relationships have developed more rapidly with some Commodity Programs than others at CIAT and those not located at the Center.

The formation of a Seed Task Force to help in preparing for this study apparently contributed significantly to the communication process within CIAT between the Seed Unit and scientists with the Commodity programs. Follow-up meetings between the leadership of the Seed Unit and the Commodity Programs continued this process. The addition of the Head of the Seed Unit to the Leadership Group of CIAT also helped the communication process. The team feels it is vital for the success of the Seed Program and the achievement of the Commodity Programs' objectives for this process to continue. Recognizing that the leadership of these activities is always subject to change, the CIAT management needs to do whatever is required to maintain a continuous flow of information between the Seed Program and the Commodity Programs of CIAT. Similarly, the leadership of the other IARCs in the region should assure that a good working relationship exists between their program scientists and the Seed Program. The first responsibility of the proposed Seed Program Advisory Committee is to "provide a coordinating mechanism in seed improvement activities between the Seed Program at CIAT and national and international agencies (including the IARCs) in the region." The team recommends that every effort be made at all levels to assure that these close working relationships grow and develop--especially with the Commodity Programs.

management issues. He felt that this was a weakness in seed programs in which national agencies urgently needed help and that there were few places they could turn to for assistance. Having worked with many national programs, the Seed Unit should have accumulated considerable experience on the subject. It is recognized that policy and management approaches will vary from country to country. However, country experience which an international agency can document and share, are invaluable as information for other countries.

There are a number of ways that the Seed Program can assist countries with policy and management problems. Among these are the following:

1. Preparation of a series of case studies.
2. Development of a common issues document identifying key elements of policy that affect seed programs.
3. Sponsoring seminars and workshops particularly for officials and industry leaders.
4. Organizing special short courses on policy and management issues.
5. Provide consulting services directly or contractual services of specialists.
6. Develop a library collection of seed laws and regulations as part of a Documentation Center on seed matters.

The Study Group felt that the Seed Unit has approached the policy issue very cautiously and undoubtedly that was a prudent approach. We feel, however, the Seed Unit and CIAT enjoy should enable the program to respond more aggressively and with confidence to request for assistance in this matter and to initiate some activities of more general nature.

The development of a Seed Science and Technology Theasurus in English and Spanish will contribute much to the development of an information network in the region. The seed sector has many potential clients for information at various levels. In Latin America, the Seed Program represents the best mechanism available for combining the technical backup with the means to disseminate information to a wide range of specialists, researchers, technologists and people in the commercial seed industry. These specialists are so vital to the success of the CGIAR system in accelerating the use of improved varieties that special attention should be given to the development of a special information channel to them. The Seed Unit newsletter has served some of this purpose, but it falls short of reaching the total potential audience and is focused primarily toward former course participants. The need is to develop a more comprehensive network that contributed more to the horizontal flow of seed information throughout the region with at least three main audiences in mind--seed researchers; seed technology, development and production specialists; and the commercial seed industry. It is recommended that the Seed Program and the Communication Services Support Unit review these needs and develop a long-range plan for developing a stronger information and communication system for the seed sector.

The role of seed associations in this information network needs special consideration. The technical and trade associations have the potential of delivering a considerable amount of information to their members. The Seed Program of the future needs to develop mechanisms that can incorporate them into this network while not by-passing them.

Policy Related Activities

A need which was mentioned frequently by individuals interviewed by the Study Team was that with policies and organizational issues related to National Seed Program. An individual in the private seed sector in Colombia said "We don't expect CIAT to define national policies, but through various actions it can indirectly influence and catalyze policy options." One of the international funding agencies representatives urged that the CIAT Seed Program give greater attention to policy and

the means to undertake more than a small fraction of this list. However, it is recommended that the means be found for the Seed Program to place greater emphasis on research related especially to the commodities of the IARCs in the region.

The intention for the Seed Program to help develop a collaborative research network in the region as stated in the CIAT report is quite desirable. It appears that some of the universities in the region and a few other institutions are in a position to assume leadership in this regard. However, at the moment most research is done in isolation and the results are frequently not widely disseminated. The Seed Program, as a regional activity, is in an excellent position to convert these intentions into actions and the team recommends that priority be given to achieving this objective. The objective should be to identify research leaders in the region who could assume responsibility for helping to obtain information on research now underway in various aspects of seed production and technology, to assist in developing groups with common interests, to jointly refine priorities and examine potential collaborative work, to maintain communication about ongoing research work, and to help disseminate results. To achieve these steps, the Seed Program will need to identify ways to relate to and assist these leaders in various ways as the collaborative network is developed.

Information and communication. The Seed Unit through its training courses and workshops has generated a tremendous amount of information not previously available in Spanish. Although the Unit has published some of this material, most of it continues to be in individual papers and not readily accessible to people in the region unless they have been a course participant. All workshop proceedings are being published with summaries of the papers presented in Spanish. Even in these cases only the proceedings on seed for small farmers have been published in English. The Unit has a considerable amount of material that also would have value for any similar activities developed in other areas. Thus, the team recommends that ways be found to accelerate the publishing of documents that are in the pipeline and of other material that will have value for others in the region and outside the region.

Obviously, a certain amount of truth exists in this position. However, in considering this aspect one must recognize the great differences that exist among the countries in the region to multiply basic seed and the differences in the stage of development of the different crops that are of concern to the IARCs working in the region. While the arguments against any basic seed production by the Seed Unit for a crop like rice are strong, the same arguments do not apply so well to seeds of tropical pastures where the stage of development of the research and seed programs for these crops are not so well advanced. It is the view of the team that basic seed production needs to be handled in a flexible manner so the Seed Program can respond to needs as expressed by the national program in the most appropriate manner as possible. Seed production can support training activities in many ways and can be a justification in itself for the activity. Thus, it is recommended that a modest level of basic seed production be maintained and that the program continue to attempt to operate this aspect of the program on a self-sufficient basis.

Research and development in seed production and technology. The initial phase of the Seed Unit's activities purposely carried a reduced emphasis on research. It was felt that much was known that could be applied without a significant research effort. The Tropical Pasture Program had a seed specialist who was devoting a part of his time to research. The greatest impact could be made initially through training and technical collaboration. All of these reasons were good; but as one looks to the future, it is important now that more effort be placed on research. As is pointed out in the CIAT report, comparative advantages exist for the Seed Program to work on high-priority projects of special interest to the CIAT Commodity Programs and those of sister International Centers. Table 8.2 lists some key areas that have been identified by the Seed Unit staff based upon their own observations and the results of the workshop on research and training held in 1985 at CIAT. This list needs further discussion with the Commodity Program leaders and definite plans developed on how and by whom this work is to be done. At the moment, the Seed Unit staff does not have the time or

Donor agencies often need the assistance of seed specialists as they develop projects to assist national programs. Sometimes "seed projects" have failed to have the necessary impact because of weak plans, an over involvement of the public sector, inadequate training opportunities for the staff, or poor follow-up. In the future, it is recommended that a more concerted effort be made by the Seed Program to offer assistance to donor agencies in order to provide a stronger technical input into the development of seed or seed related projects. A special workshop or seminar among the donor and technical assistance agencies in the region in cooperation with the seed and Commodity Programs could be useful in developing future collaboration among these groups.

As plans and projects are developed, technical collaboration could take the form of not only assisting the implementation of the plans at the national level but also helping the development of sub-networks including people at the subregional and regional level leading the basic Seed Unit, the seed associations, the quality control activities, national seed programs leaders, and the seed programs of universities.

Seed production and use. As stressed in earlier sections, it is clear that the ultimate objective of the Seed Unit has been to increase the production and use of improved varieties. The development of stronger basic seed units and of increased capability at the commercial seed level are part of the strategy. The CIAT report clearly stresses these as priority areas of work for the future. It also states, "Training, technical collaboration and actual seed production by the Unit will support these developments." The only question that has been raised in this regard centers around the role of the Seed Unit in the production of basic seed. Some people express the view that this is an inappropriate and unnecessary activity for the the Seed Program at CIAT to assume. It is argued that basic seed production by an IARC is in fact working against the very objective of trying to get these programs operating at the national level.

universities to CIAT to do some joint planning. However, recognizing the growing need from well-trained people at various levels requires that the universities play a stronger role in the future. Today only two universities in the region offer a M.S. level degree in seed production and technology. No Ph.D. degrees can be obtained in this discipline in the region. As a way to accelerate the building of the long-term basis for the growing personnel and research needs of the region, it is recommended that the Seed Program play a leadership role in helping the development of key university programs. For the seed sector these lead universities in seed production and technology can be as important as many other seed activities carried out by national governments.

Technical collaboration. A substantial amount of technical collaboration has been achieved during the past eight years through the Seed Unit's work at the national and subregional levels. However, when this work is compared with need as expressed by the past workshops, the people visited and the Commodity Programs of the IARCs, much remains to be done. One senses a great amount of receptivity and expectations at the national level. The solid base of past technical collaboration and large numbers of course and workshop participants provides many open doors and opportunities to make significant impact. The future seed effort should grasp these opportunities and respond as positively as possible.

The technical collaboration is the means through which the planning process can be achieved to help countries establish their goals, strategies and policies. Thus, opportunities are opened to develop a functional integrated system, to help link research, extension, and the seed sector, to identify and help channel needed financial and technical resources to the seed sector from within and outside the country, and to provide the mechanisms for future follow-up and support from the seed and Commodity Programs. It is through technical collaboration and the planning process that the Seed Program can relate most closely with donor and technical assistance agencies as is pointed out in the CIAT report.

The CIAT location is also excellent for sharply defined in-service training programs, but the candidates for these programs must be carefully selected to assure that the maximum possible impact is achieved when the person returns to his or her regular position. Joint training opportunities in seed and with selected Commodity Programs also contribute to an increased focus based upon crop oriented priorities for particular countries.

An increased concentration of training at the subregional and national level is needed. It is recommended that the future Seed Program stimulate additional and more sharply focused training at these levels to meet specific needs that are known to exist. As more effort is placed on developing national seed training plans, the logical follow-up is to carry out the planned courses. Training at this level has the advantage that it can lead to helping to overcome a range of production and organizational problems that exist, so training should be viewed as a way to achieve many of the other program objectives in addition to the addition to the technical knowledge of the course participants. This kind of training has the further advantage that it can reach to the hundreds of people concerned with seed growing, conditioning, marketing, quality control and assurance, planning, extension, credit, and research to help the process of integrating all groups concerned and able to contribute to the acceleration of the use of improved varieties in a country. In all these training activities the Seed Program's strategy must continue to be the motivation and increased participation of local and regional leadership. The Seed Unit has operated with this strategy in the past in part because of its limited staff. The strategy works and should not be lost as the Seed Program offers assistance to the region.

Seed production and technology at the university level has been a neglected discipline in the region. The Seed Unit's willingness to accept people from universities in training courses has helped strengthen these programs and two workshops have brought leaders from

projects, but as a part of the same package. The amount is not so great but what one donor might be willing to support the entire package. However, it would be useful for stability and continuity of the program to actively enlist the assistance of other donors. This step could also have the benefit of providing a core of support for the further development of similar activities in the Middle East and Africa in cooperation with other IARCs in those areas.

Activities to Achieve the Program

A summary of activities that might be performed by the Seed Program is shown in Table 8.1.

Training and conferences. The Seed Unit's training strategy has been unique and innovative. It has been the only continuous seed improvement oriented training activity offered on a regional basis in the developing world. Its link with an international agricultural research center has provided it with a strong base from which to work. Looking to the future, questions regarding who to train, where to train and for what purpose should training be offered need to be answered. The CIAT report deals with these questions somewhat, but the team feels some points need further special emphasis.

Although many future decision makers have been in past courses, much greater effort needs to be placed on helping these leaders grasp the key seed sector improvement concepts than has been achieved in the past. Special workshops and seminars especially for this group need to be added to the program with a concerted effort to identify and involve people who can influence the future improvement of the seed sector. The higher level technical leaders can be reached through the planned advanced, specialized courses at CIAT. Many of these people are the people who can lead future training activities at the subregional and national level. Providing them with specialized training in course development and improving communication skills would be appropriate. The intended concentration on these kinds of courses is sound and provides the means to build upon the base that now exists in the region.

Facilities. The Seed Unit facilities are unique in the developing world since they have been designed especially for training purposes. Most of what has been discussed can be achieved without major changes in the basic facilities and equipment. Some improvement in equipment may be needed depending upon the nature of the future research work done. However, it is important that the Seed Program become fully aware of equipment now in CIAT and the availability of these resources before it attempts to add items to its own base. The additional staff projected will require some consideration be given to the addition of some office space since the present office area is fully utilized.

Budget. The present yearly expenditures of the Seed Unit are approximately \$800,000.00 including all administrative and service costs. The addition of one senior staff member and the added support expected at headquarters could add \$200,000.00 to the yearly headquarters budget. The two outreach positions and the local support for them could be in the range of \$150,000.00 per year for each of them. Thus, a total expenditure on the Seed Program of approximately \$1.3 to \$1.4 million could be projected including the outposted positions. This expenditure would be about five to six percent of the CIAT total budget. If it is considered in terms of the CGIAR expenditures in the Latin American region, it would represent slightly over two percent of the total.

Financial support. The Seed Unit has received its major support, approximately \$5.5 million, during the past eight years from the Swiss Development Cooperation. Initially this support was as a special project. Subsequently, the support was handled as restricted core when the special project was transferred to core status.

To achieve the financial objectives outlined earlier, it is recommended that CIAT management examine the possibility of developing a multi-donor restricted core package to support the Seed Program with a commitment of a minimum of five years. The same donors might be interested in and able to support the outreach positions as special

provides it with the means to offer more than is now being utilized by the programs. The seed testing laboratory is not fully utilized and could test larger quantities of samples for the Commodity Programs. As the Commodity Programs add to their seed capability, it is recommended that increased attention be given to seed quality and packaging especially of material that moves out of CIAT for trials.

It is recommended that the Seed Program further strengthen its capability to offer services in the layout and design of facilities. Although this information has been provided in some training courses, the means to provide initial layouts from which architects can work in preparing final plans for facilities is becoming increasingly requested of the Unit. The organization and supplying of current information on equipment sources from within and outside the region is a needed service that can become a part of the overall information service provided by the Seed Program.

Increased cooperation and planning between the Genetic Resources Unit and the Seed Program will be useful. Some sharing of staff and facilities will often be mutually beneficial. Research areas will overlap so joint consideration of needs and ways to meet them will be increasingly important. The Seed Health Testing Laboratory can contribute to training and research for the Seed Program, especially as the staff in that laboratory is upgraded. The Seed Program should not develop independent seed health work, but instead should work toward increased collaboration with the GRU activities.

Similar links with the Biotechnology Unit will become increasingly important. The electrophoresis capability now in that Unit has value for the Seed Program. The multiplication of virus-free planting material will become increasingly important for the seed multiplication work and to demonstrate these methods for people in national seed programs and with private organizations.

ANNEX 3

SEED PRODUCTION AND TECHNOLOGY RESEARCH TOPICS

1. Tropical pasture seed quality evaluations on three species.
2. Environmental - variety interaction with respect to characters to use in describing rice and bean varieties.
3. Testing of the methodology on variety description by describing eight Colombian rice varieties grown in five locations.
4. Evaluation of the costs of establishing and operating seed conditioning facilities of different sizes in Colombia and Guatemala.
5. Factors affecting the quality of bean seed used by small farmers.
6. Improvement of stand establishment of rice based on protection from early attack of "Piricularia" and insects.
7. Methodologies for obtaining high quality pasture seed of two species.
8. Utilization of the uniform blowing method to simplify seed purity analysis of two tropical pasture species.
9. Potential utilization of an infra-red seed moisture tester with tropical pasture seed.
10. Comparative tests to assess bean seed viability as determined by the ASAC 1000 and standard germination tests.
11. Evaluation of a small solar dryer that needs no other source of energy to dry bean seed.



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ANNEX 2

ORGANIZATIONS AND PERSONS CONTACTED

<u>Organization</u>	<u>Individuals</u>
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12. Basados en su permanente comunicación con la Unidad de Semillas y/o colegas, cómo podría la Unidad de Semillas prestar más apoyo al desarrollo del sector semillista de la región?
13. El CIAT ha enviado cantidades pequeñas de semilla básica a precios reales de semilla básica, con el interés de acelerar la adopción de nuevas variedades recomendadas por algunos países. Anticipa la necesidad de este tipo de apoyo en el futuro cercano para su programa?
14. Qué tipo de apoyo se necesitaría para fortalecer su programa de semilla básica? y para que dicho programa pudiera contribuir más efectivamente al desarrollo de la industria de semillas?
15. Cómo percibe el papel de la Unidad de Semillas en lo que respecta a las actividades que realiza con asociaciones locales y regionales de semillas?
16. De qué manera podría la Unidad de Semillas del CIAT colaborar con el sector de semillas en el futuro? Por ejemplo: a) capacitación en el CIAT, capacitación a nivel nacional, regional, seminarios y conferencias?; b) diagnóstico de programas de semillas?, identificación y elaboración de proyectos?, ejecución de proyectos?, otras formas de asistencia técnica; c) suministro de semilla genética y básica?; d) información y documentación; e) otros.
17. Qué otras necesidades anticipa usted para el futuro, si necesitara mejorar el sector de semillas?

ANNEX 1

PREGUNTAS CLAVES PARA DISCUSION

Estado Actual

1. Qué desarrollo ha tenido el sector de semillas en su país en los últimos 10 años?
2. Ha existido algún proyecto especial de semillas que fortifique el sector semillista en los últimos 10 años?
3. Qué prioridad dá el gobierno al mejoramiento de la cantidad y la calidad de semilla para los agricultores? Cómo se traduce ese interés en acciones concretas?
4. Qué porcentaje de la semilla usada por los agricultores es abastecida por las empresas de semillas y qué porcentaje produce y guarda su propio grano para "semilla"? Caso maíz, arroz, frijol, sorgo y otros.
5. Ha habido algún cambio en el sector semillista que pudiera atribuirse a las actividades de la Unidad de Semillas del CIAT?
6. Cuáles son las grandes limitaciones en el sector público y privado en el área de semillas?
7. Existe alguna actividad o programa específico para tratar de mejorar el suministro de semilla a los pequeños agricultores?

Necesidades Futuras

8. Qué recursos financieros o técnicos, nacionales o internacionales considera usted que serían necesarios para apoyar el sector de semillas en el futuro?
9. Existen suficientes recursos financieros internos como para alcanzar los objetivos o será necesario recursos externos de fuentes como el Banco Mundial, BID, USAID, otros?
10. Si se van a desarrollar proyectos con apoyo financiero externo, habrá necesidad de que la Unidad de Semillas juegue un papel catalizador a través de la preparación o ejecución de proyectos de semillas, facilitando así la integración de aspectos técnicos y financieros?
11. En su concepto, cómo se podría aumentar la manera de que las personas capacitadas en semillas fueran utilizadas más efectivamente para alcanzar las metas propuestas por su programa?

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3. It is recommended that the Seed Program expand its research emphasis to deal with the many problems of seed quality, conservation, and performance in the tropics. A strong collaborative program with national institutions should be the heart of the research effort.
4. It is recommended that training courses involve the joint participation of the Seed Program and the Commodity Programs and that Seed Program facilities should be used more intensively by the Commodity Programs.
5. It is recommended that the Commodity Programs take advantage of the Seed Program capabilities in promoting the adoption of their materials in countries of the region.
6. It is recommended that the Seed Program assist in the process of vegetative seed multiplication in national seed programs.
7. It is recommended that the Seed Program strengthen its capacity to provide or arrange for consultancies in the development of seed production entities in seed legislation, policy formulation, economic analysis related to the seed sector.
8. It is recommended that the Seed Program establish closer linkages with the Commodity Research Programs to assure that new varietal materials as they are being formed possess good seed characteristics.
9. It is recommended that the support that the Seed Unit has provided to other IARCs especially those in the region, be continued if not expanded and should be recognized as a positive action of the Seed Unit within the CGIAR system.

4. It is recommended that CIAT encourage the CGIAR to adopt a seed sector policy and develop a CGIAR-wide strategy in which the CIAT experience could be most helpful. It should be emphasized that seed conservation in the tropics is more complex than in temperate regions and that successful seed production in the tropics requires research and technology to resolve those special problems.
5. It is recommended that management continue to assist in the integration of the commodity and seed program activities as well as to strengthen linkages with other Units in CIAT.
6. It is recommended that CIAT Management examine the possibility of developing a multi-donor restricted core package that should extend for a minimum of five to eight years for the support of the Seed Program.
7. In order to maximize the support of the Seed Program in developing national seed programs, it is recommended that CIAT consider the possibility of adding a position in the Seed Program in the area of Policy, Economic Analysis and Management and an outreach person in each of the two regions where seed systems are weakest (Andean and Central America).

Recommendations to the Seed Unit

1. It is recommended that the Seed Program begin immediately to project itself into strengthening national and regional seed sector activities especially linked to Commodity Programs by increasing consultation services promoting commodity seed needs and training in-country.
2. It is recommended that training programs be more clearly targeted to key institutions and individuals where responsibilities are unambiguously linked to seed sector systems.

CHAPTER IX. RECOMMENDATIONS

Many of the recommendations that are given below could be implemented without structural changes in the Seed Program. We believe that an immediate objective of CIAT should be to assure the ongoing capability of the Seed Program in strengthening national seed programs. Its work to date has had a very positive impact as noted especially by an expanding private seed sector in the region. This task needs to be completed while at the same time making it possible to support seed development in other geographic regions. Over the medium (3-5 years) and longer term (5-10 years), CIAT and the CGIAR will have to decide what strategy is most appropriate to assure that seed production and availability is not a major constraint to the adoption of materials emerging from the IARCs.

Recommendations to CIAT Management

1. In view of the nature of the Commodities on which CIAT works, it is recommended that CIAT view the Seed Program as a vital and integral part of its efforts to assist nations improve the adoption process of new genetic materials.
2. As long as the Seed Unit remains within the Core Programs of CIAT, it is recommended that it be identified as the Seed Program.
3. It is recommended that a Seed Advisory Committee be appointed which reports to the Board and advises and assists the Seed Program in orientation of its activities, facilitating interaction with national programs and agencies and in identifying sources of support.

Table 8.2. Continued

	BEANS	RICE	TPP	CASSAVA	MAIZE	SORGHUM	SEED	JOINTLY		
<u>Andean Region:</u>										
Bolivia **	2	3	3				1	2		
Colombia	1	3	1 '87 1 '88		1		1	1		
Ecuador	2+	1 '87 1 '88	3 2				1	1		
Perú**	2+	2 '87 2 '88	2 '87 2 '88	TO BE DEFINED	1 '87 1 '88	TO BE DEFINED	1	2		
Venezuela	3	2 1 '88	3 2 '88					2	2	
Brazil *	2+	2 '87 1 '88	2 2 '88						1	1
<u>Southern Cone:</u>										
Argentina	3	3	3				3	3		
Chile	2	3 '87 2 '88	-				3	2		
Paraguay	3	3	3				3	3		
Uruguay	3	3	3				3	3		

* Selected Areas

** With possibility of becoming priority 1 in view of the current interest and momentum.

Table 8.2. Target Areas for a Seed Effort^{1/}

	BEANS	RICE	TPP	CASSAVA	MAIZE	SORCHUM	SEED	JOINTLY
México *	3+	3	3 / 2				2	3
<u>Central America:</u>	3	3	3 / 2				3	3
Costa Rica			2					
El Salvador	2+	3	3				2+	2+, 3
Guatemala	1 '87	2 '87 / 1 '89	3				1	1
Honduras	2	2 '87 / 1 '89	3				2	2
Nicaragua	3	3	3				3	3
Panamá	3	1 '87 / 1 '88	3 / 2				1	1
<u>Caribbean Region:</u>								
Barbados	3	3	3	TO BE DEFINED	TO BE DEFINED	TO BE DEFINED	3	3
Belize	3	3	3	TO BE DEFINED	TO BE DEFINED	TO BE DEFINED	3	3
Cuba	3	3	3				3	3
Dominican Rep.	3	2	3				2	3
Guyana	3	3	3				3	3
Haiti	3	3	3				3	3
Jamaica	3	3	3				3	3
Trinidad	3	3	3				3	3

* Selected States

^{1/} Ratings:

- 1 = High Priority
- 2 = Some special attention
- 3 = Normal general assistance

Table 8.1. Continued

REQUIRED ACTIVITIES	DESIRABLE ACTIVITIES	POTENTIAL ACTIVITIES
<p>- Production of basic seed for CIAT Commodity Programs in support of new cultivar releases and considering this activity also as a training tool for seed technology courses.</p>	<p>- Expand consultancy services to help with:</p> <ul style="list-style-type: none"> • National seed committees and agencies responsible for development of seed policies plan, basic seed production, extension and distribution, legislation and credit. • National or international development agencies and seed enterprises interested in promoting seed sector investments. <p>- Direct collaboration with groups responsible for implementing a national seed plan in aspects such as: management, legislation, credit and marketing.</p> <p>- Encourage collaboration among national or regional research efforts in seed technology and expand research undertaken at CIAT.</p> <p>- Provide more direct contact and support to national programs through outposted staff at the subregional level.</p> <p>- Strengthen and support seed and professional association development with updated technological information and program development and in their relations to other national or regional associations.</p>	<p>- Develop a proposed uniform legislation and methodology guidelines and encourage their adoption and use.</p>

Table 8.1. Categories of Activities that could be Carried Out by the Seed Program Depending on Availability of Resources

REQUIRED ACTIVITIES	DESIRABLE ACTIVITIES	POTENTIAL ACTIVITIES
<ul style="list-style-type: none"> - Continue the organization of Intensive Seed Technology Courses on: <ul style="list-style-type: none"> ● Basic Seed Production. ● Drying and Conditioning. ● Organization & Management of Production. ● Distribution and Marketing. 	<ul style="list-style-type: none"> - Promotion at the government level of the seed sector importance in agricultural development and support of policy actions and financial incentives that benefit the seed sector. 	<ul style="list-style-type: none"> - Encourage the development of associative research programs among universities in the region (M.Sc. and Ph.D. level) to strengthen long term in country training and research activities.
<ul style="list-style-type: none"> - Organize courses in conjunction with and according to the needs of CIAT Commodity Programs. 	<ul style="list-style-type: none"> - Strengthen national seed capacity of countries in the region through training activities in: <ul style="list-style-type: none"> ● Promotion of seed technology courses as part of agronomic curricula in universities. ● Intensive Seminars in Seed Program Development for responsible officials in each country. ● Strengthen professional training capacity in national entities with support through Seed Unit. 	<ul style="list-style-type: none"> - Help in the definition of priorities for research and in the formulation of the corresponding action programs.
<ul style="list-style-type: none"> - Determine and carry out specific but limited research activities related to seed problems in the region. 	<ul style="list-style-type: none"> - Continue to stimulate seed production at small farmer's level, and develop alternative strategies to improve artesanal seed production. 	<ul style="list-style-type: none"> - Support of standardization of seed legislations and seed quality control procedures at the regional level to promote the production and regional marketing of seeds.
<ul style="list-style-type: none"> - Prepare training materials on: <ul style="list-style-type: none"> ● Crop oriented seed technology ● Organizational schemes of seed flow according to the particular needs of countries in the region. 	<ul style="list-style-type: none"> - Preparation of national crop and seed production and use plans to support the accelerated production, distribution and adoption of new varieties. 	<ul style="list-style-type: none"> - Develop a seed information network and inter-regional or interinstitutional collaboration for information exchange.
		<ul style="list-style-type: none"> - Support the development of the regional association as a way to achieve development of the seed sector.